

M. E. J.

BULLETIN

of the

American Association of Petroleum Geologists

CONTENTS

Introduction to Cretaceous of California	<i>By Olaf P. Jenkins</i> 249
Standard of Cretaceous System	<i>By Siemon Wm. Muller and Hubert G. Schenck</i> 262
Upper Cretaceous Stratigraphy of West Side of Sacramento Valley South of Willows, Glenn County, California	<i>By J. M. Kirby</i> 279
Cretaceous: East Side Sacramento Valley, Shasta and Butte Counties, Cali- fornia	<i>By W. P. Popenoe</i> 306

THE ASSOCIATION ROUND TABLE

Membership Applications Approved for Publication	313
Association Committees	314
Past and Present Officers of the Association	316
Joint Annual Meeting, Fort Worth, April 7-9, 1943	316
Association Membership List, March 1, 1943	323
Financial Statement for 1942	403
Financial Statement, Division of Paleontology and Mineralogy, 1942	408
Memorandum of National Service Committee	<i>By F. L. Aurin</i> 412



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BULLETIN

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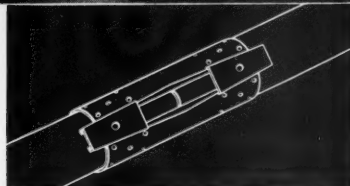
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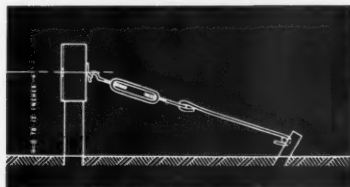
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Dowell Incorporated viii	Reed Roller Bit Company xl
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Frost Gravimetric Surveys	Seismograph Service Corporation Cover ii
General Geophysical Company xxxvi	Society of Exploration Geophysicists xxvii
Geophysical Service, Inc. Cover iii	Spencer Lens Company xxiv
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Hughes Tool Company, Inc. Cover iv	Triangle Blue Print and Supply Company xvii
Illinois Powder Company	United Geophysical Company xxxix
Independent Exploration Company xxi	Western Geophysical Company xxxii
Journal of Geology	Wiley & Sons, John
Journal of Paleontology xvii	

PROFESSIONAL CARDS

California ix	Kansas x	Pennsylvania xi
Colorado ix	Louisiana x	Texas xi, xii, xiii
Illinois ix	New York x	West Virginia xiii
Iowa x	Ohio x	Wyoming xiii
	Oklahoma xi	

GEOLOGICAL AND GEOPHYSICAL SOCIETIES

Appalachian xvi	Illinois xiv	Rocky Mountain xiv
Ardmore xv	Indiana-Kentucky xiv	Shawnee xv
Corpus Christi xv	Kansas xiv	Shreveport xiv
Dallas xv	Michigan xiv	South Louisiana xiv
East Texas xvi	Mississippi xv	South Texas xvi
Exploration Geophysicists xvi	New Orleans xiv	Stratigraphic xv
Fort Worth xvi	North Texas xvi	Tulsa xv
Houston xvi	Oklahoma City xv	West Texas xvi

Articles for April Bulletin

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By C. E. DOBBIN

Wasson Field, Yoakum and Gaines Counties, Texas

By W. T. SCHNEIDER

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BULLETIN
of the
**AMERICAN ASSOCIATION OF
PETROLEUM GEOLOGISTS**

MARCH, 1943

INTRODUCTION TO CRETACEOUS OF CALIFORNIA¹

OLAF P. JENKINS²
San Francisco, California

ABSTRACT

The bibliographic history of the California Cretaceous, beginning with J. B. Trask in 1855, is briefly outlined. A list of the various Cretaceous units of the state is presented. The distribution of these rocks from the Oregon line to the Mexican border, from the Pacific Ocean to the foot of the Sierra Nevada, is indicated on a map of California, showing, also, the Cenozoic cover, and older basement rocks and Franciscan group. General thicknesses of the Cretaceous, taken at various points throughout the state, are shown on a map to give data for isopachs, which in turn indicate the possible positions of geosynclinal basins of deposition. Cretaceous economic products—building stone, gold, oil, and gas—are shown to be in direct relationship to major epochs in the geologic history of California.

FOREWORD

The pendulum of interest and activity in the study of the Cretaceous rocks of California has taken 80 years to swing; economic interest in mineral fuels has guided its course. First, the interest was in coal, which finally was found to be Eocene in age; later, it proved to be of no commercial importance. Now the interest is in gas; but what is the origin of this gas? Is it related to petroleum? And what are the chances it will have lasting importance?

When the Cretaceous was first found it was thought to be Tertiary; when lower Tertiary beds were first studied they were taken to be Cretaceous; when the Jurassic Knoxville and Franciscan sediments were first extensively examined they were considered to be metamorphosed Cretaceous.

As a matter of fact, much of the monotonous lithology of the Franciscan is similar to the Knoxville; the Knoxville sandstones and shales are with great difficulty differentiated from the Lower Cretaceous; many Upper and Lower Cretaceous beds are confused with one another; and it is a well recognized fact that Paleocene and Upper Cretaceous are even difficult to separate on fossil evidence. Even in distribution, these formations seem to follow one another throughout the state. They are characterized by lithologic uniformity—conglom-

¹ Read before the Pacific Section of the Association at Los Angeles, October 16, 1941. Manuscript received, December 18, 1941.

² Chief geologist, California State Division of Mines, Ferry Building.

erates, sandstones, and shales—a deposition of detrital material not accompanied by vulcanism except in rare instances. The most noticeable unconformity and change in formation occurs in the middle of the series, between Lower and Upper Cretaceous.

It seems strange, indeed, that a group of unmetamorphosed sediments, with an accumulated stratigraphic thickness of at least 8 miles, could have been nearly neglected so far as detailed mapping, stratigraphy, and structure are concerned, for so many years.

HISTORY³ OF STUDY OF CALIFORNIA CRETACEOUS FIRST DESCRIPTION OF CRETACEOUS FOSSILS BY TRASK

The year 1855 appears to mark the beginning of the study of Cretaceous fossils of California, when John Boardman Trask, first State geologist, described *Baculites chicoensis* and other Cretaceous fossils from northern California, which he thought occurred in Tertiary rocks.

WORK OF GABB ON GEOLOGICAL SURVEY OF CALIFORNIA UNDER WHITNEY

The explorations of the second Geological Survey of California under J. D. Whitney in 1861 "revealed the presence of Cretaceous rocks in the Mount Diablo Range." In fact, Whitney said "that the existence of the Cretaceous formation in the State was first recognized" in the Mount Diablo region. Apparently, since the coal of this area was then regarded as "included in the sandstones belonging to the upper part of the Cretaceous," much attention was given to these rocks.

In 1862, W. M. Gabb was employed as paleontologist, and in 1864 "Paleontology—Volume I" was issued by the State Survey. This book was devoted largely to Cretaceous fossils. Unfortunately, it included as Cretaceous many Eocene as well as other Tertiary forms.

Whitney, in 1869, showed that the "Cretaceous formation" was divided into four groups, as follows:

- 1st. The Tejon Group, the most modern member, the Division B of Paleontology, Vol. I, is peculiar to California. . . . It is the only coal-producing formation in California. . . .
- 2d. The Martinez Group . . . It may eventually prove to be worthy of ranking only as a subdivision of the Chico Group.
- 3d. The Chico Group is one of the most extensive and important members of the Pacific Coast Cretaceous. . . .
- 4th. The Shasta Group is a provisional name, proposed to include a series of beds of different ages, but which, from our imperfect knowledge of the subject, cannot yet be separated; it includes all below the Chico Group.

This mixing of Eocene with the Cretaceous was soon called to the attention of the world by Conrad in 1866, who determined the differences in age of the fossils without ever entering the field in California.

³ Practically all the references to publications which are merely cited in this "introduction" and in the accompanying charts showing "bibliographic history" and "geologic units" of the California Cretaceous, may be found in published bibliographies of the California State Division of Mines, *Bulletins* 104, 115, 118, and *California Journal of Mines and Geology*, Vol. 35, No. 3 (1939).

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	YEAR WHEN FORMATION WAS DESCRIBED																			
Alderson zone (Kl)	41																41			
Asuncion group (Ku)																				
Atascadero formation (Ku)									04											
Baker member (Ku)																41				
Bellavista stage (Ku)	41																			
Butte gravels (Ku, E, F)																			29	
Butte stage (Ku)	41																			
Chico Creek beds (Ku)	37																			
Chico formation (Ku)									69											
Chico-Tejon series (Ku, E)																			89	
Cima sandstone (Ku)																41				
Cottonwood beds (Kl)	38																			
Dos Palos shale member (Ku)																41				
Duncan zone (Kl)	41																			
Forbes formation (Ku)												41								
Funks formation (Ku)												41								
Gaines group (Ku)	37																			
Garzas beds (Ku)	37																			
Golden Gate formation (Ku)												41								
Gualala series (Ku)																		41		
Guinda formation (Ku)												41								
Hemlin-Broad zone (Kl)	41																41			
Holt member (Ku)																				
Horsetown formation (Kl)																			85	
Hulen beds (Kl)	38																			
Joaquin stage (Ku)	41																			
Knoxville formation (J, Kl)																			85	
Ladd formation (Ku)																	41			
Los Gatos formation (Ku)	37																			
Marca shale (Ku)																41				
Marysville formation (Ku)																			29	
Mercy sandstone (Ku)																41				
Mills formation (Ku)												41								
Mitchell zone (Ku)	41																			
Mono shale (E or K)														25						
Moreno formation (Ku)	15																			
Mustang shale (Ku)						41														
Oakland conglomerate member (Ku)			02																	
Oro zone (Kl)	41																			
Orestimba group (Ku)	38																			
Pacheco group (Ku)																	41			
Pachydiscus silt (Ku)												41								
Panoche formation (Ku)	15																			
Paskenta formation (Kl)	02																			
Pescadero series (Ku, E, M)					95															
Pine Canyon shale (Ku)												41								
Pioneer group (Ku)	38																			
Pleasants member (Ku)																	41			
Quinto (Ku)	41																			
San Pedro shales (K)								07												
Schultz member (Ku)																	41			
Shasta-Chico series (Klu)								93												
Shasta series (Kl)									69											
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Sylvester zone (Kl)	41																			
Toro formation (J, K)								04												
Trabuco formation (Ku)															16					
Volta (Ku)	38																			
Wallala group (Ku)					85															
Williams formation (Ku)																	37			
Yolo stage (Ku)	41																			

FIG. 1.—Geologic units of Cretaceous of California and their authors.

AUTHOR	VOLUME 25 NO. 8 AUGUST 1941	NO. OF PAGES
Ambrose, A. W.	/	1
American Association of Petroleum Geologists		
Anderson, F. M.		20
Anderson, R.	/	5
Applin, E. R.		5
Arnold, R.	/	1
Ashley, O. H.		1
Becker, G. F.		1
Bennison, A.	/	1
Blake, W. P.		3
Branner, J. C.	/	1
Brewer, W. H.		1
Bryan, K.	/	1
Campbell, A. S.		3
Church, C. C.		1
Clark, W. B.	/	1
Claypole, E. W.	/	3
Conrad, T. A.	/	2
Cooper, J. G.	/	1
Crandall, R.		1
Crickmay, C. H.		3
Crook, C. M.		2
Cushman, J. A.		1
Dickerson, R. E.		1
Diller, J. S.		1
Dumble, E. T.		1
Dunn, R. L.	/	1
English, W. A.	/	1
Fairbanks, H. W.		3
Farquhar, F. P.		1
Gabb, W. M.	/	4
Hammer, H. E.	/	7
Hanus, G. D.		1
Hawley, H. J.		1
Hershof, O. H.		1
Hinds, W. Z. A.		1
Hollister, J. S.		1
Ruey, A. S.		1

EARLY WORK OF UNITED STATES GEOLOGICAL SURVEY ON QUICKSILVER

In 1885, C. A. White, of the United States Geological Survey, divided the Shasta series, on fossil evidence, into the Knoxville beds below and the Horsetown beds above, believing that *Aucella* was restricted to the Knoxville, and suggesting that there was probably a hiatus between the two formations, but including both in the Lower Cretaceous. These subdivisions have been held by the Federal Survey to the present time, in spite of the contentions of local California geologists that the lower part of White's Knoxville is Jurassic, actually.

During the decade that followed (1886-1896), the United States Geological Survey made extensive field investigations of the quicksilver and gold resources of California, and this study required work with the late Mesozoic. The Knoxville was made to include all pre-Horsetown rocks of the Coast Ranges.

The names of White, Becker, Diller, Turner, Stanton, Fairbanks, and others appear prominently during those years in the study of the Cretaceous and Jurassic rocks. Some actual mapping of areas, as in the San Luis Folio by Fairbanks, shaped the study in a more concrete form. If this detailed mapping had continued in regions where the Cretaceous and latest Jurassic rocks are abundantly and well exposed, a better concept of their stratigraphy would undoubtedly have developed.

Diller, in 1894, even delved into paleogeography. He said:

During the Cretaceous period, especially during that portion represented by the Shasta-Chico beds, the northern part of California and Oregon gradually subsided and the sea transgressed, sweeping around the northern end of the Sierra Nevada through Lassen strait, the gap where Lassen Peak now stands, between the Sierra Nevada and Klamath mountains, into northeastern California and Oregon. The Klamath mountains, during the early part of this period, at least, formed an island. The sea entered northern Oregon directly from the west as well as from California on the south.

During these early years gold was actually found in the conglomerates of the Cretaceous that flank the Klamath Mountains. One writer on the State Mining Bureau (Dunn, 1894) thought that the conglomerates of the Upper Cretaceous represented a Mesozoic auriferous river channel.

WORK OF F. M. ANDERSON WITH CALIFORNIA ACADEMY OF SCIENCES

The earliest paleontologic work on the Cretaceous of California was done by members of the California Academy of Sciences, and it is noteworthy that this study is still vigorously being carried on, especially by F. M. Anderson.

The first citation of Anderson's work on the Cretaceous appears to be in 1895, "Some Cretaceous Beds of the Rogue River Valley, Oregon." Another important early paper of his was issued in 1902 by the California Academy of Sciences on the "Cretaceous Deposits of the Pacific Coast." Throughout the 46 years which have passed between 1895 and 1941, Anderson has been constantly at work in this same study. Now, after publishing outstanding papers on the "Knoxville-Shasta Succession in California" in 1932 and 1933, and monographing the "Lower

Cretaceous Deposits in California and Oregon" for publication by the Geological Society of America, we find him completing another monograph on the Upper Cretaceous. This work has been both paleontologic and stratigraphic. It has not, however, been accompanied by detailed geologic and structural mapping—the most needed of all researches to clarify problems in historical geology.

One of the most significant results of F. M. Anderson's work is the definite establishment of the boundary between the Jurassic and Lower Cretaceous. The upper part of the original "Knoxville" he calls "Paskenta"; the overlying Horsetown is a continuation of the sedimentation of the Paskenta, together forming the Lower Cretaceous. Between the Paskenta and the Knoxville, thus restricted, is a definite unconformity, with transgression of the Cretaceous over the Jurassic. This feature is now well recognized by local field geologists.

MAPPING OF COAST RANGE OIL GEOLOGY BY UNITED STATES GEOLOGICAL SURVEY

The decade that followed the Federal Survey's investigations of quicksilver and gold was one of important mapping of Coast Range oil geology, between 1906 and 1916. This mapping, though restricted largely to the Tertiary formations, included some important Cretaceous areas. In connection with the Cretaceous, the names of Arnold, Robert Anderson, Pack, English, J. P. Smith, Branner, and Lawson are particularly important.

An outstanding result of this work, besides the detailed mapping, was the discovery by Robert Anderson that the Moreno shale, a highly organic formation, undoubtedly a source of oil, occupied the upper part of the Upper Cretaceous.

Immense thicknesses of the Cretaceous were measured and mapped. Careful stratigraphic and structural work in the lower part of the section was, however, somewhat neglected.

PERIOD OF NEGLECT OF CRETACEOUS

The next decade, 1917 to 1926, was one of nearly complete neglect of the California Cretaceous. Apparently no use could be found in it.

RECENT STUDIES OF CRETACEOUS

The time since 1926, however, may be regarded as a recent revival of Cretaceous study. Hanna, in 1927, described diatoms from the Moreno formation; Cushman and Church described Foraminifera from the same formation. Reed's book, *Geology of California*, stimulated further work.

Reed summarized "paleogeographic suggestions" as follows.

1. The land areas of Cretaceous time were Mohavia and Salinia, the extent of the latter being very uncertain. The Klamath area was emergent at first, but may have been covered later.
2. The climate of the land areas may have been cooler in Knoxville than in Chico time. The rainfall was seemingly sufficient to allow the development of dense forests. There is at least a suggestion of evidence in favor of the view that there may have been a rainy and a dry season, or at least a more and a less rainy season each year.
3. The centers of subsidence of Cretaceous basins of accumulation were east of those of Franciscan time, and were farther east during Chico than during Cretaceous time.

4. The depth of the sea, at least during the deposition of the preponderant laminated siltstone, may have been from 50 to 100 feet.

The study of "source beds in the late Mesozoic on the west side of the Sacramento Valley" by Trask and Hammar in 1934 showed a uniformly rather low organic content, 0.87 per cent in the Shasta series and 0.6 per cent in the Chico.

Taff and Cross, in 1935, mapped the Mount Diablo region (where intensive Cretaceous study first began). They also mapped the Sacramento Valley, and the data have been incorporated into the 1938 Geologic Map of California. Together with Hanna they have recently (1940) published on the type locality of the Chico.

Popenoe has worked in the Cretaceous throughout the state and has recently mapped in detail the Cretaceous of the Santa Ana Mountains.

A large area of thick Cretaceous sediments has been mapped by Taliaferro in the Santa Lucia Range; the stratigraphic relationships of the Upper and Lower Cretaceous, and that of the Knoxville and Franciscan have been extensively studied by him. Probably the most important features Taliaferro has proved are the apparent conformity, or rather synonymy, of the Knoxville and Franciscan (long thought to be separated by profound unconformity); the definite establishment that the Coast Range serpentines intrude the Jurassic Franciscan-Knoxville series, but not the Paskenta formation; and the recognition of two large groups of sedimentary formations (Pacheco and Asuncion) comprising the Upper Cretaceous and separated from one another by a profound unconformity, representing an orogenic episode—the Santa Lucian orogeny.

In addition to these results of important recent investigations, is the finding of marine vertebrates in the upper part of the Upper Cretaceous on the west side of the San Joaquin Valley and also in the Franciscan near by.

The winning of commercial deposits of gas in the Upper Cretaceous and the hope of encountering oil have largely been responsible for this renewed activity and interest in these late Mesozoic sediments.

With all this historical discussion, no mention at all has been made of the important ore-depositing period of the Upper Jurassic, and possibly Cretaceous, and its relationship to the Nevadan orogeny. The gold deposited by reason of this eventful period is next to oil in importance on the production chart of California's commercial minerals.

SCIENTIFIC SIGNIFICANCE OF CRETACEOUS

The Cretaceous of California is of great scientific as well as economic importance; it occupies a strategic position in the geologic column; it is remarkably well developed, probably every known stage being represented in some part of the state. Although it was deposited in an immense and long-enduring geosyncline, there were many interruptions in deposition, many periods of warping and even folding, and slight shifting (apparently on the east) of the major geosynclinal axis. This is especially true of the Upper Cretaceous when there were important movements, resulting in strong unconformities on the western margin of the geosyncline.

Fossils are very abundant in many places and at a number of horizons, but there are also vast thicknesses in which they are exceedingly scarce. Furthermore, deposition nearly everywhere took place in shallow water, resulting in rapid lateral variation. For these reasons, it is exceedingly difficult to establish definite correlations over widely separated areas. Much work remains before even the major features of the history of the Cretaceous are fully known.

The accompanying four maps have been developed largely from the writer's Geologic Map of California of 1938 (scale 1:500,000), from known stratigraphic thicknesses of surface exposures secured from many sources, and measured in various places throughout the state, and from other accumulated data.

It is fully realized that the thicknesses do not take into account the various unconformities. This means that considerable thicknesses of sediments in a number of places were removed from the sections during the time of the Cretaceous. Many of the sections measured are not in themselves complete. Therefore, the isopach map is not to be taken too seriously, because it is based on much information that is misleading as regards total thicknesses of the sedimentary column.

The general paleogeographic map of the Cretaceous as a whole, though based on known distribution, stratigraphic thicknesses, character of sediments, and position of basement rocks, is necessarily in large part the result of imagination and is subject to many revisions. As for the preparation of separate paleogeographic maps of the different divisions of the Cretaceous, our present state of knowledge does not justify such extended exercise of the imagination.

GEOLOGIC SIGNIFICANCE OF ECONOMIC MINERALS

GOLD

In both Upper and Lower Cretaceous, gold has been found in conglomerates on the eastern and southeastern flank of the Klamath Mountains, between this province and the Sierra Nevada. The deposits are small, but they represent the unroofing of these mountains and exposure of the veins which were formed from solutions given off by the granitic invasion of the Nevadan orogeny. By Eocene time, however, erosion was deep enough to reach the richer parts of the veins. This action, together with long secular decay and weathering, released an immense amount of gold in Eocene time, which was favored by a warm semi-tropical climate, and in addition, a stand-still physiographic surface not to be found in any other part of the rest of the Tertiary or Quaternary.

COAL

In the Lower Cretaceous, coal deposits are localized in areas in the southern part of the Klamath Mountains. Diller found coal in the Upper Cretaceous 8 miles northeast of Yreka. At Point Loma, coaly material is reported from the Upper Cretaceous.

The most important coal-forming period of California is the upper Eocene, first thought to be Cretaceous by the early California Geological Survey. Coal

PALEOGEOGRAPHIC MAP

Explanation

LAND AREAS

AXIS OF GEOSYNCLINE

STRENGTHENING OF THE JUDICIAL SYSTEM

[illegible]

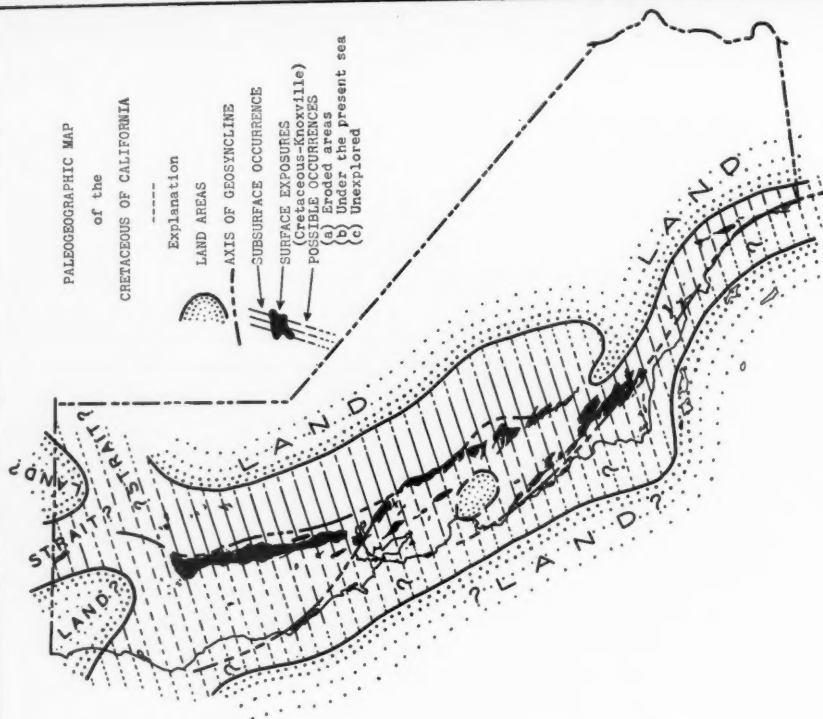
SURFACE EXPOSURES
(Cretaceous-Knoxville)

(Cretaceous-Knoxville)
POSSIBLE OCCURRENCES

(a) Eroded areas

(a) Eroded areas
(b) Under the present

(b) Under the present s



DISTRIBUTION
of
CRETACEOUS SURFACE EXPOSURES
SHOWING THEIR RELATION
to the
MAJOR ROCK UNITS

Explanation

Cenozoic sediments

Cenozoic volcanic rocks

100

1000

[illegible]

Metamorphic and granitic

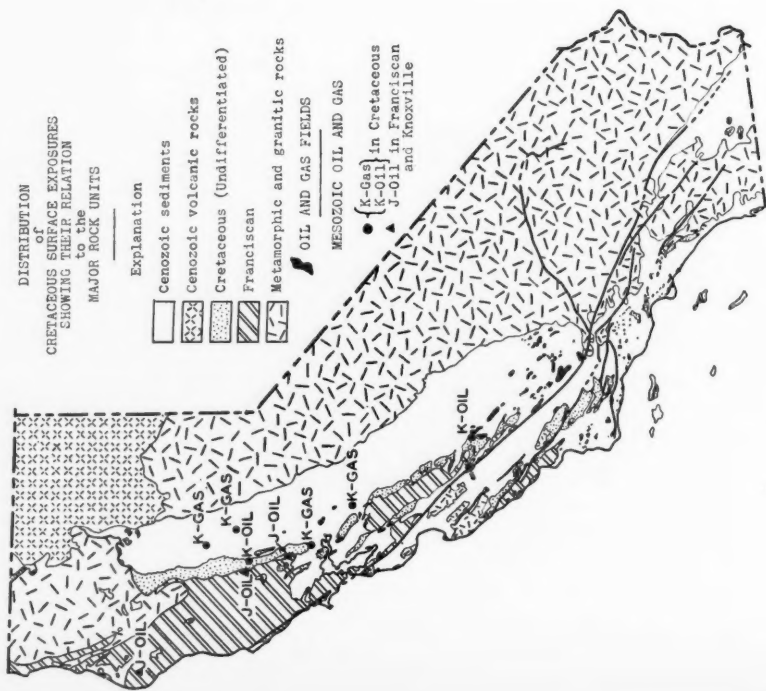
OIL AND GAS FIELDS

MESOZOIC OIL AND GAS

Q10 Q11 Q12 Q13 Q14 Q15 Q16 Q17 Q18 Q19 Q20 Q21 Q22 Q23 Q24 Q25 Q26 Q27 Q28 Q29 Q30 Q31 Q32 Q33 Q34 Q35 Q36 Q37 Q38 Q39 Q40 Q41 Q42 Q43 Q44 Q45 Q46 Q47 Q48 Q49 Q50 Q51 Q52 Q53 Q54 Q55 Q56 Q57 Q58 Q59 Q60 Q61 Q62 Q63 Q64 Q65 Q66 Q67 Q68 Q69 Q70 Q71 Q72 Q73 Q74 Q75 Q76 Q77 Q78 Q79 Q80 Q81 Q82 Q83 Q84 Q85 Q86 Q87 Q88 Q89 Q90 Q91 Q92 Q93 Q94 Q95 Q96 Q97 Q98 Q99 Q100 Q101 Q102 Q103 Q104 Q105 Q106 Q107 Q108 Q109 Q110 Q111 Q112 Q113 Q114 Q115 Q116 Q117 Q118 Q119 Q120 Q121 Q122 Q123 Q124 Q125 Q126 Q127 Q128 Q129 Q130 Q131 Q132 Q133 Q134 Q135 Q136 Q137 Q138 Q139 Q140 Q141 Q142 Q143 Q144 Q145 Q146 Q147 Q148 Q149 Q150 Q151 Q152 Q153 Q154 Q155 Q156 Q157 Q158 Q159 Q160 Q161 Q162 Q163 Q164 Q165 Q166 Q167 Q168 Q169 Q170 Q171 Q172 Q173 Q174 Q175 Q176 Q177 Q178 Q179 Q180 Q181 Q182 Q183 Q184 Q185 Q186 Q187 Q188 Q189 Q190 Q191 Q192 Q193 Q194 Q195 Q196 Q197 Q198 Q199 Q200 Q201 Q202 Q203 Q204 Q205 Q206 Q207 Q208 Q209 Q210 Q211 Q212 Q213 Q214 Q215 Q216 Q217 Q218 Q219 Q220 Q221 Q222 Q223 Q224 Q225 Q226 Q227 Q228 Q229 Q230 Q231 Q232 Q233 Q234 Q235 Q236 Q237 Q238 Q239 Q240 Q241 Q242 Q243 Q244 Q245 Q246 Q247 Q248 Q249 Q250 Q251 Q252 Q253 Q254 Q255 Q256 Q257 Q258 Q259 Q260 Q261 Q262 Q263 Q264 Q265 Q266 Q267 Q268 Q269 Q270 Q271 Q272 Q273 Q274 Q275 Q276 Q277 Q278 Q279 Q280 Q281 Q282 Q283 Q284 Q285 Q286 Q287 Q288 Q289 Q290 Q291 Q292 Q293 Q294 Q295 Q296 Q297 Q298 Q299 Q300 Q301 Q302 Q303 Q304 Q305 Q306 Q307 Q308 Q309 Q310 Q311 Q312 Q313 Q314 Q315 Q316 Q317 Q318 Q319 Q320 Q321 Q322 Q323 Q324 Q325 Q326 Q327 Q328 Q329 Q330 Q331 Q332 Q333 Q334 Q335 Q336 Q337 Q338 Q339 Q340 Q341 Q342 Q343 Q344 Q345 Q346 Q347 Q348 Q349 Q350 Q351 Q352 Q353 Q354 Q355 Q356 Q357 Q358 Q359 Q360 Q361 Q362 Q363 Q364 Q365 Q366 Q367 Q368 Q369 Q370 Q371 Q372 Q373 Q374 Q375 Q376 Q377 Q378 Q379 Q380 Q381 Q382 Q383 Q384 Q385 Q386 Q387 Q388 Q389 Q390 Q391 Q392 Q393 Q394 Q395 Q396 Q397 Q398 Q399 Q400 Q401 Q402 Q403 Q404 Q405 Q406 Q407 Q408 Q409 Q410 Q411 Q412 Q413 Q414 Q415 Q416 Q417 Q418 Q419 Q420 Q421 Q422 Q423 Q424 Q425 Q426 Q427 Q428 Q429 Q430 Q431 Q432 Q433 Q434 Q435 Q436 Q437 Q438 Q439 Q440 Q441 Q442 Q443 Q444 Q445 Q446 Q447 Q448 Q449 Q450 Q451 Q452 Q453 Q454 Q455 Q456 Q457 Q458 Q459 Q460 Q461 Q462 Q463 Q464 Q465 Q466 Q467 Q468 Q469 Q470 Q471 Q472 Q473 Q474 Q475 Q476 Q477 Q478 Q479 Q480 Q481 Q482 Q483 Q484 Q485 Q486 Q487 Q488 Q489 Q490 Q491 Q492 Q493 Q494 Q495 Q496 Q497 Q498 Q499 Q500 Q501 Q502 Q503 Q504 Q505 Q506 Q507 Q508 Q509 Q510 Q511 Q512 Q513 Q514 Q515 Q516 Q517 Q518 Q519 Q520 Q521 Q522 Q523 Q524 Q525 Q526 Q527 Q528 Q529 Q530 Q531 Q532 Q533 Q534 Q535 Q536 Q537 Q538 Q539 Q540 Q541 Q542 Q543 Q544 Q545 Q546 Q547 Q548 Q549 Q550 Q551 Q552 Q553 Q554 Q555 Q556 Q557 Q558 Q559 Q560 Q561 Q562 Q563 Q564 Q565 Q566 Q567 Q568 Q569 Q570 Q571 Q572 Q573 Q574 Q575 Q576 Q577 Q578 Q579 Q580 Q581 Q582 Q583 Q584 Q585 Q586 Q587 Q588 Q589 Q590 Q591 Q592 Q593 Q594 Q595 Q596 Q597 Q598 Q599 Q600 Q601 Q602 Q603 Q604 Q605 Q606 Q607 Q608 Q609 Q610 Q611 Q612 Q613 Q614 Q615 Q616 Q617 Q618 Q619 Q620 Q621 Q622 Q623 Q624 Q625 Q626 Q627 Q628 Q629 Q630 Q631 Q632 Q633 Q634 Q635 Q636 Q637 Q638 Q639 Q640 Q641 Q642 Q643 Q644 Q645 Q646 Q647 Q648 Q649 Q650 Q651 Q652 Q653 Q654 Q655 Q656 Q657 Q658 Q659 Q660 Q661 Q662 Q663 Q664 Q665 Q666 Q667 Q668 Q669 Q670 Q671 Q672 Q673 Q674 Q675 Q676 Q677 Q678 Q679 Q680 Q681 Q682 Q683 Q684 Q685 Q686 Q687 Q688 Q689 Q690 Q691 Q692 Q693 Q694 Q695 Q696 Q697 Q698 Q699 Q700 Q701 Q702 Q703 Q704 Q705 Q706 Q707 Q708 Q709 Q710 Q711 Q712 Q713 Q714 Q715 Q716 Q717 Q718 Q719 Q720 Q721 Q722 Q723 Q724 Q725 Q726 Q727 Q728 Q729 Q730 Q731 Q732 Q733 Q734 Q735 Q736 Q737 Q738 Q739 Q740 Q741 Q742 Q743 Q744 Q745 Q746 Q747 Q748 Q749 Q750 Q751 Q752 Q753 Q754 Q755 Q756 Q757 Q758 Q759 Q760 Q761 Q762 Q763 Q764 Q765 Q766 Q767 Q768 Q769 Q770 Q771 Q772 Q773 Q774 Q775 Q776 Q777 Q778 Q779 Q780 Q781 Q782 Q783 Q784 Q785 Q786 Q787 Q788 Q789 Q790 Q791 Q792 Q793 Q794 Q795 Q796 Q797 Q798 Q799 Q800 Q801 Q802 Q803 Q804 Q805 Q806 Q807 Q808 Q809 Q810 Q811 Q812 Q813 Q814 Q815 Q816 Q817 Q818 Q819 Q820 Q821 Q822 Q823 Q824 Q825 Q826 Q827 Q828 Q829 Q830 Q831 Q832 Q833 Q834 Q835 Q836 Q837 Q838 Q839 Q840 Q841 Q842 Q843 Q844 Q845 Q846 Q847 Q848 Q849 Q850 Q851 Q852 Q853 Q854 Q855 Q856 Q857 Q858 Q859 Q860 Q861 Q862 Q863 Q864 Q865 Q866 Q867 Q868 Q869 Q870 Q871 Q872 Q873 Q874 Q875 Q876 Q877 Q878 Q879 Q880 Q881 Q882 Q883 Q884 Q885 Q886 Q887 Q888 Q889 Q890 Q891 Q892 Q893 Q894 Q895 Q896 Q897 Q898 Q899 Q900 Q901 Q902 Q903 Q904 Q905 Q906 Q907 Q908 Q909 Q910 Q911 Q912 Q913 Q914 Q915 Q916 Q917 Q918 Q919 Q920 Q921 Q922 Q923 Q924 Q925 Q926 Q927 Q928 Q929 Q930 Q931 Q932 Q933 Q934 Q935 Q936 Q937 Q938 Q939 Q940 Q941 Q942 Q943 Q944 Q945 Q946 Q947 Q948 Q949 Q950 Q951 Q952 Q953 Q954 Q955 Q956 Q957 Q958 Q959 Q960 Q961 Q962 Q963 Q964 Q965 Q966 Q967 Q968 Q969 Q970 Q971 Q972 Q973 Q974 Q975 Q976 Q977 Q978 Q979 Q980 Q981 Q982 Q983 Q984 Q985 Q986 Q987 Q988 Q989 Q990 Q991 Q992 Q993 Q994 Q995 Q996 Q997 Q998 Q999

• {K-Gas}

● {K-011 in Cretaceous



deposits generally characterize a warm, humid climate, which in turn favors the release of gold from bedrock.

BUILDING STONE

The Upper Cretaceous massive sandstones, nearly void of fossils, which have been extensively quarried in Santa Clara, Colusa and Los Angeles counties for building stone, indicate, to some extent at least, the results of the great erosional period of the Cretaceous. The Stanford University Quad is built of this sandstone.

OIL

Jurassic.—In the Jurassic, oil is found at Petrolia, Humboldt County, in the deepest part of the western Franciscan geosyncline, in organic rocks, such as limestones, on an anticline, probably of a very early period. Small globules of oil are often found with the Plio-Pleistocene quicksilver deposits which occur in the early Jurassic serpentine structures and Franciscan sediments. Oil is also found in a deep part of the eastern Jurassic-Knoxville geosyncline, at Wilbur Springs, on an anticline probably of a very early period.

Lower Cretaceous.—In the Lower Cretaceous, oil is found at Mountain House, Colusa County, and at other near-by localities, in the deepest part of the geosyncline of that time and in a structure which is probably of a very early period.

Upper Cretaceous.—In the Upper Cretaceous, oil is found and commercially produced in the organic shale of the Moreno formation (containing an abundance of Foraminifera and the oldest known diatoms), on an anticline which is thought to have begun forming in early Eocene time. Farther west, near New Idria, the anticline began, according to Taliaferro, in the mid-Cretaceous.

Factors of consideration for oil accumulation.—The time of formation of an anticline, relative to that of sedimentary deposition, should be considered one of the most important factors in the migration and accumulation of oil; for if a long time elapses between sedimentation and folding, compaction of sediments and induration of the rocks, including induration of carbonaceous material, work unfavorably against the migration and accumulation of oil. The diastrophism of the Paleocene, following the deposition of the Cretaceous, was exceptionally quiet as compared with other times in the Tertiary. The sparseness of organic material, diluted in the great thicknesses of detrital sediment of the Cretaceous, is undoubtedly another important factor which may account for the lack of great oil deposits in the Cretaceous.

GAS

In the Upper Cretaceous, within its geosynclinal basin and located in the northern-central part of the alluvial- and Eocene-covered Great Valley plain of California (probably never covered by a very great Tertiary load) in well trapped structures, occur commercially productive gas deposits. In places it is difficult to tell whether the gas comes from the Upper Cretaceous or from the overlying

Eocene. It is doubtful that the gas has a petroliferous origin; more likely its source is from plant remains and coaly material such as that found in the Eocene beds exposed on both sides of the Great Valley.

CONCLUSIONS

Regional geologic features should be considered of primary importance in the exploration for economic minerals.

The occurrence of minerals of economic value is valuable also as an indicator of important events in geologic history, besides giving financial support and aiding interest to scientific study.

STANDARD OF CRETACEOUS SYSTEM¹

SIEMON WM. MULLER AND HUBERT G. SCHENCK
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ABSTRACT

A preliminary report on this subject was read before the Pacific Section of the Association on October 16, 1941. The present paper incorporates slight revisions based on suggestions from several colleagues, notably Gayle Scott, Hans E. Thalmann, and John B. Reeside, Jr., and his associates.

The standard of the Cretaceous system represents a composite time-rock column—a total or complete sequence of strata between the Jurassic and the Cenozoic. This standard has been built up by fitting together continuous sections which are especially well exposed in several areas in Europe. The system is subdivided into series, stages and zones. These divisions are based on paleontologic evidence, with no regard to thicknesses of strata and their lithologic character. Particular attention is drawn to the early work of d'Orbigny in setting up the stages of the entire Cretaceous system. A detailed analysis of a zone clarifies the meaning of this time-stratigraphic term. A study of the boundaries between the underlying Jurassic and the overlying Cenozoic leads to the conclusion that the lowest Cretaceous stage is the Berriasian and the highest is the Danian.

INTRODUCTION

The writers accepted the invitation to read this paper on the standard of the Cretaceous system because they are eager to take part in the analysis of the current problems which have been brought to the fore through the efforts of the many geologists and paleontologists working on the Cretaceous of California. The present paper is only a report of progress of the investigation.

Several years ago during travels abroad the writers became directly concerned with the Cretaceous in its widest scope. They have had the unusual opportunity of examining a number of critical localities and of studying museum collections of Cretaceous fossils. They have also discussed various issues with many people who are regarded as the leaders in the study of the Cretaceous. European scientists have escorted them to several of the type localities of the various divisions of the Cretaceous. American paleontologists and stratigraphers most cordially cooperated with their efforts. It is a privilege, therefore, to acknowledge here the help they have received from Henri Douvillé, M. Gilbert, R. W. Imlay, C. Poulsen, J. P. J. Ravn, John B. Reeside, Jr., Gayle Scott, L. F. Spath, L. W. Stephenson, Curt Teichert, and T. H. Withers.

Personal experience thus taught that although the problems encountered in widely separated areas may differ widely in scope and character, the principles which underlie the procedure leading to their solutions remain the same. Regardless of the region or of the nature of the specific problem, the ultimate solution of most stratigraphic problems has essentially the same objective: precise geologic history. This can be accomplished only when facts are evaluated in terms of some established standard of reference. This is why it is necessary to consider a yard-

¹ Read in part before the Pacific Section of the Association at Los Angeles, California, October 16, 1941; abstract in *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 25, No. 11 (November, 1941), p. 2095. Also presented before the annual meeting of the Association in Denver, Colorado, April 23, 1942; abstract in *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 26, No. 5 (May, 1942), p. 906. Manuscript received, April 24, 1942.

stick of measure, the generally accepted European standard of the Cretaceous system.

To enumerate the units which constitute the standard of the Cretaceous is only a part of the present purpose. Another concern is how the concept of the standard came into being and how its component parts were established. An example of a zone is also given because it is the fundamental part of a standard or total section.

ORIGINAL DEFINITION

The Cretaceous system was originally designated by d'Omalius d'Halloy in 1822 as "terrains crétacés." A reading of the text and an examination of the map (Fig. 1) show that he regarded as the type area of the terrains the Paris basin, part of Belgium, the Netherlands, and a small area in western Germany.

The English spelling of the word Cretaceous, as it is used to-day, probably dates from 1822 when Conybeare and Phillips used the term the "Cretaceous" as an adjective describing the Chalk. Several attempts were made in the years that followed to restrict the name Cretaceous to beds with chalk lithology, but the inclusion of the immediately subjacent sands and marls eventually prevailed. In this extended scope the name Cretaceous is accepted generally to-day.

D'ORBIGNY'S STAGES

Succession of stages.—The most important contribution to the study of the Cretaceous system was made by Alcide d'Orbigny in his monumental volumes, *Paléontologie française, Terrains crétacés* (1840–1846), and in his later textbook, *Cours élémentaire de Paléontologie et de Géologie stratigraphiques*, which appeared in 1852. These are the foundation of all subsequent work on the Cretaceous.

The definition of the Cretaceous by d'Orbigny is as follows, translated freely from page 570 of his *Cours*.

We designate under the term "Terrains crétacés" the succession of stages which occupy the interval between the Portlandian beds, the last Jurassic deposits, and the Nummulitic stage, or the Suessonian, the first member of the Tertiary terrain. We place in the "terrains crétacés" all of the stages from the Neocomian to the beds at Laversine which constitute the Danian stage, inclusive. This perfectly circumscribed entity is distinguished clearly from the subjacent and superjacent terrains by the summation of all paleontologic and stratigraphic considerations, the results of which are in most perfect agreement.

The succession of Cretaceous strata thus defined is illustrated by a generalized cross section from Vassy (Haute Marne) to Vertus (Marne), France, where a complete sequence of stages is exposed without gaps. This figure (393 of the *Cours*, Fig. 2 here) shows a succession of stages labelled in ascending stratigraphic order.

Stage	
17th	Neocomian
18th	Aptian
19th	Albian
20th	Cenomanian

Stage	
21st	Turonian
22nd	Senonian
23rd	Danian

TYPE AREA OF CRETACEOUS SYSTEM

AS ORIGINALLY DEFINED BY

J.J. D'OMALIUS D'HALLOY

ANNALES DES MINES, TOME 7ME, 1822

1 50 100 200
KILOMETERS

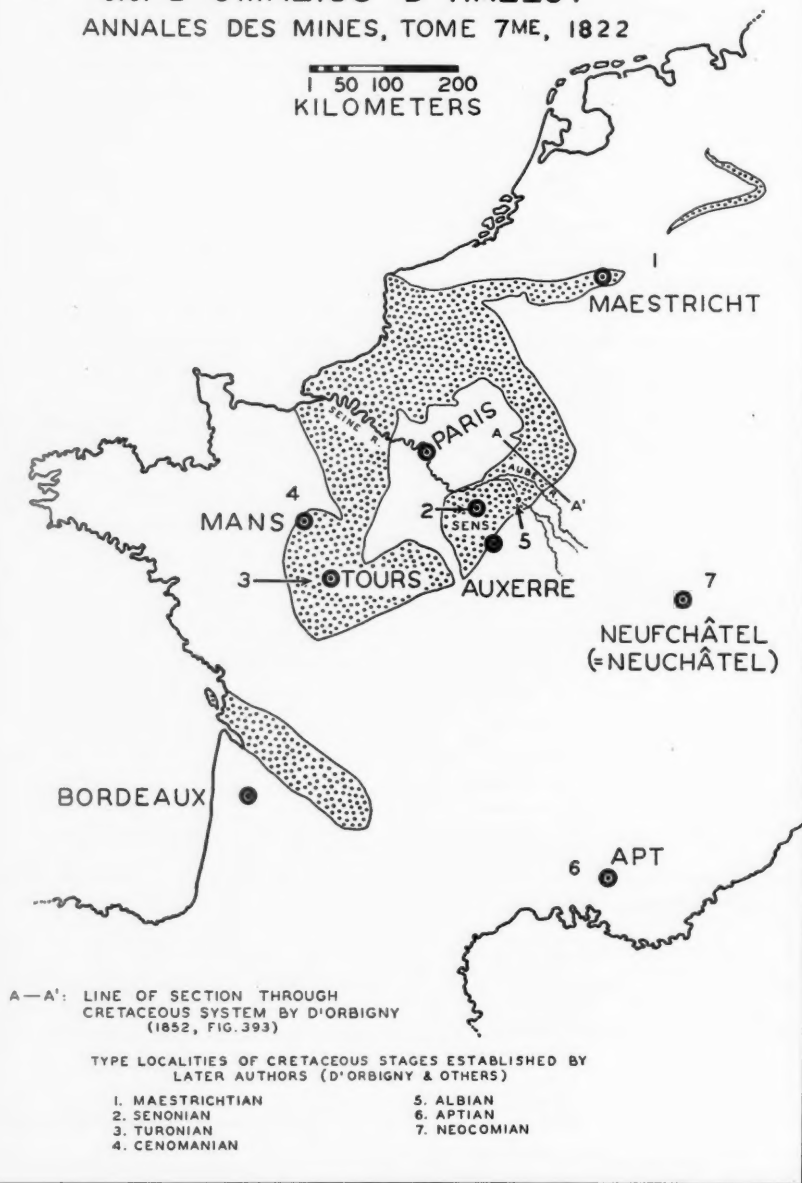


FIG. 1.—Index map of type area of Cretaceous system, based on map of J. J. d'Omalus d'Halloy, 1822.

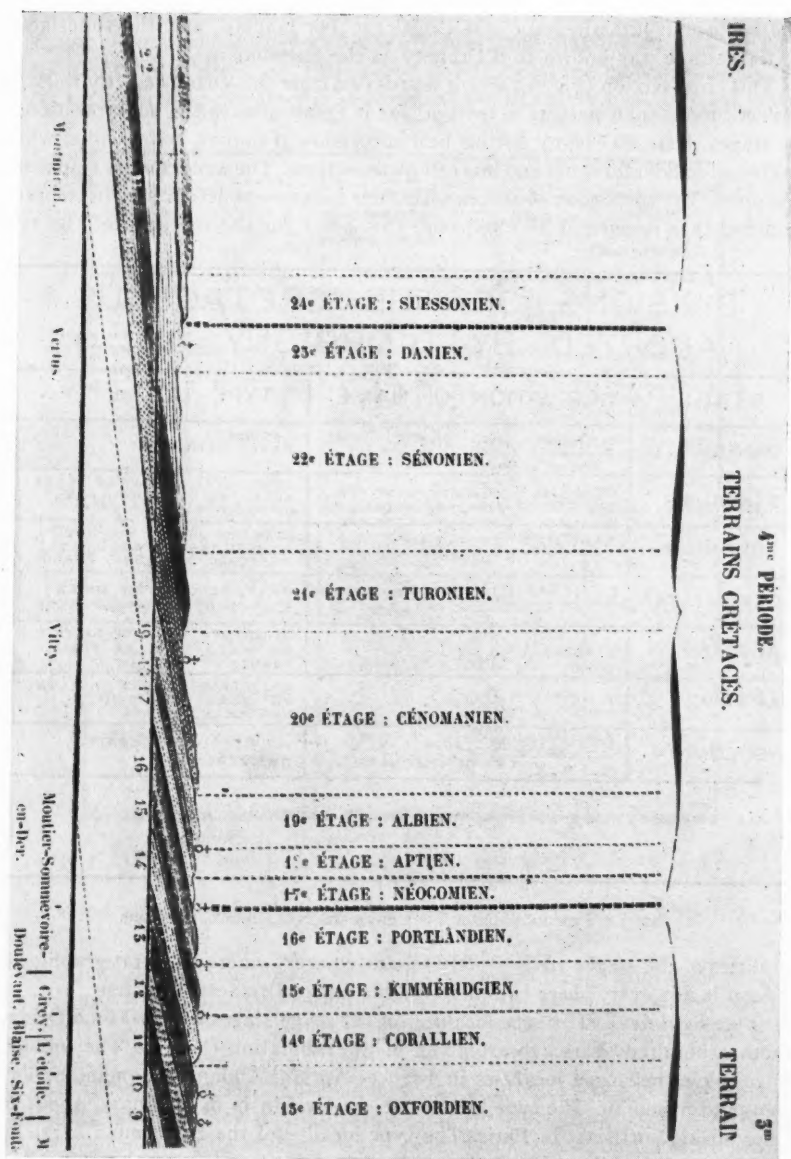


FIG. 2.—Generalized section from Vassy to Vertus, France, from d'Orbigny (1852, Fig. 393).
See AA', Fig. 1.

The subjacent Jurassic stage was called the Portlandian, and the superjacent Tertiary stage was known to d'Orbigny as the Suessonian.

This cross section (Fig. 2), which was drawn from the Voges westerly to Paris, deserves more than passing attention, for it demonstrates the superposition of the stages. Here d'Orbigny got his best succession of faunas, a succession which was found to hold for other and less complete sections. The writers must emphasize this point: the succession of stages with their faunas was determined in complete sections. It is important to emphasize this point for the reason that the type

DIVISIONS OF THE CRETACEOUS ADOPTED BY D'ORBIGNY, 1852 (1)		
STAGE	DERIVATION OF NAME	TYPE LOCALITY
DANIAN	<u>DANIA</u> , LATIN FOR DENMARK	FAXE, DENMARK
SENONIAN	<u>SENONES</u> , ANCIENT NAME FOR THE CITY OF SENS	SENS, DEPARTMENT OF YONNE, ABOUT 60 MILES SOUTHEAST OF PARIS, FRANCE
TURONIAN	<u>TURONIA</u> , ANCIENT NAME FOR TOURAINE, FRANCE	BETWEEN SAUMUR AND MONT-RICHARD, ABOUT 40 MILES WESTERLY FROM TOURS, FRANCE
CENOMANIAN	<u>CENOMANUM</u> , LATIN NAME FOR CITY OF MANS	MANS, ABOUT 120 MILES SOUTHWEST OF PARIS, FRANCE
ALBIAN	L'AUBE (<u>ALBA</u>)	DEPARTMENT OF AUBE, ABOUT 110 MILES EAST OF PARIS, FRANCE
APTIAN	<u>APT</u> , A TOWN	APT, DEPARTMENT OF VAUCLUSE, 40 MILES NORTH OF MARSEILLE, FRANCE
NEOCOMIAN	<u>NEOCOMUM</u> , LATIN NAME OF CITY OF "NEUFCHÂTEL"	VICINITY OF NEUCHÂTEL, SWITZERLAND
(1) ALL STAGES ESTABLISHED BY D'ORBIGNY EXCEPT DANIAN AND NEOCOMIAN		

FIG. 3.—Type localities of d'Orbigny's stages of Cretaceous system.

localities of the stages are in widely separated areas where the stratigraphic succession is not everywhere complete for the entire Cretaceous system.

Type localities.—The type localities of the seven stages adopted by d'Orbigny about a hundred years ago are given in the tabulation (Fig. 3). The following stages have their type localities in France: Aptian, Albian, Cenomanian, Turonian, and Senonian. The type locality of the Danian is in Denmark, about 650 miles airline northeast of Paris. The type locality of the Neocomian (Fig. 1) is in the vicinity of Neuchâtel, Switzerland, some 250 miles southeast of Paris. Attention is directed to the fact that the type localities of the Senonian and Albian are easterly from Paris in the Paris basin, whereas the type localities of the Turonian and Cenomanian are westerly from Paris in the basin. Apt, the

type locality of the Aptian, is some 350 miles, a little east of south from Paris.

Stages independent of lithology.—D'Orbigny stated that the mineralogic composition of the strata can not be followed in setting up the divisions of the Cretaceous, as lithologic character is nowhere in complete agreement with the strati-

ETAGES.	A L'OUEST du bassin anglo-parisien, dans la Sarthe et en Touraine.	DANS LA Charente-Inférieure, Bassin pyrénéen.	A L'EST du bassin anglo-parisien.	SUR LE VERSANT occidental des Alpes. Bassin méditerranéen
DANIEN....	(Manque.)	(Manque.)	Calcaire blanc poreux.	(Manque.)
SENONIEN..	Craie tufau, jaune ou blanche; craie blanche.	Craie tufau blanche ou grise, compacte ou marneuse.	Craie blanche avec ou sans silex.	Craie marneuse grise (calcaires noirs dans les Pyrénées).
TURONIEN..	Craie tufau blanche ou bleuâtre.	Craie compacte ou friable, blanche ou jaune.	Craie blanche ou craie argileuse bleue; calcaires compactes avec ou sans silex.	Craie marneuse ou calcaire, grès ferrugineux.
CÉNOMANIEN	Craie chloritée, calcaire blanc, grès rouges ou verts, argile bleue ou jaune.	Calcaire compact blanc, calcaire argileux bleu, grès rouges ou verts, argiles noires bitumineuses.	Craie blanche argileuse, ou craie bleuâtre; grès ferrugineux.	Calcaires bleus ou blancs.
ALBIEN.....	(Manque.)	(Manque.)	Argiles bleuâtres et grès rouges ou verts.	Craie chloritée.
APTIEN. ...	(Manque.)	(Manque.)	Argiles grises ou ferrugineuses; fer oolithique exploité à Vassy.	Argiles noires, calcaires bleus.
NEOCOMIEN.	(Manque.)	(Manque.)	Calcaire jaune ou bleu, grès blancs, fer hydraté exploité près de St-Dizier.	Calcaire chloriteux; calc. blancs ou bleus, argileux, avec ou sans chlorite.

FIG. 4.—Tabulation from d'Orbigny (1852, p. 577); comparison of lithology of stages.

graphic and paleontologic horizons. He wrote, freely translated from page 574 of his *Cours*:

We have followed these horizons without having regard for the mineralogic composition and we have seen all the difficulties disappear by application of the two criteria of stratigraphic demarcation of stages: superposition and the limits of the faunas in the strata.

That the stages he set up are independent of lithology can be seen from his tabulation, which is here reproduced (Fig. 4) from his *Cours*. Reference to the column for the east side of the Anglo-Parisian basin, shows one that the Albian stage consists of bluish clay and red or green sandstone, whereas the Albian in the Mediterranean Basin consists of chloritic chalk. The lithology of the Cenomanian, Turonian, and Senonian, on the other hand, is remarkably similar.

The total thickness of the Cretaceous stages in western Europe is about 13,000 feet. The following are d'Orbigny's approximate thicknesses from page 577 of the *Cours*.

	Meters		Meters
Danian.....	15	Albian.....	46
Senonian.....	300	Aptian.....	200
Turonian.....	200	Neocomian.....	2,500
Cenomanian.....	500		

Stages are world-wide.—D'Orbigny went to great pains to explain that the stages are not simply local divisions, but that they are world-wide in application. In Part I of Volume II of his *Cours* (pp. 261-62), he affirmed that the same stages which he set up in France can be recognized in England, Germany, Italy, Spain, America, and elsewhere. He concluded that the stages are the expression of divisions which Nature has traced over the entire globe.

Nature of paleontologic record for stages.—Several thousand species of fossils were utilized by d'Orbigny in establishing the stages. He said (p. 580) that in the Cretaceous strata there are more than 5,000 animal species which are different from the animals of the earlier and later periods. Of the Jurassic genera, 184 failed to survive into the Cretaceous, and 514 of the Tertiary genera known to d'Orbigny are absent in Cretaceous beds.

D'Orbigny's procedure.—The thoroughness and the orderliness of the procedure which was followed by d'Orbigny in establishing these separate stages nearly a century ago may be regarded, even in the light of modern standards of work, as of exemplary quality. Here, in brief, is the plan which he followed in defining his stages.

1. He summarized the outstanding paleontologic features of each stage. He cited a number of forms which appeared for the first time in the stage, which ones had their "flourishing period" then, and those organisms which are restricted to the stage.
2. He discussed the derivation of the name, and designated the type locality of the stage.
3. Next he gave the synonymy, followed by a brief citation under the captions "French type," "English type," and so on, of the localities where the stage is well developed. These are comparable with the paratypes of the systematic biologist.
4. Areal distribution is the heading of the next section. Here he enlarged upon the preceding discussion, giving what would appear to be all the localities known to him where strata of the stage crop out.
5. The topic "stratification" summarized the stratigraphic evidence for the establishment of the stage. He generally gave evidence to prove that at some locality a given stage is conformable between the two adjacent stages. Sometimes he added separate paragraphs dealing with the upper and lower limits of the stage.
6. The next topic was unconformities. Here he cited localities where a given stage rests unconformably on older rocks.
7. Deductions drawn from the position of the beds is the title of his succeed-

ing subject. This is usually in the nature of a brief tectonic summary.

8. The paragraph dealing with mineralogic composition described the lithology of the beds and discussed changes of facies.

9. The thickness of the stage is given in a separate section. For example, the Senonian is 100 meters thick at Saint-Ander, but 300 meters at other localities.

10. Deductions drawn from the nature of the sediments, and from the fossils, is the subject of a paragraph, which to-day might be called paleogeography. At this point in his discussion, he often added other paragraphs dealing with paleoecology and related topics.

11. The eleventh topic the writers have translated into modern language: eustatic changes.

12. The writers also take liberty in translating the twelfth topic as "Closing orogeny" for the French "perturbation finale." D'Orbigny supposed (p. 612) that a period of earth movement existed between each two stages.

13. The foregoing topics were chiefly of a stratigraphic nature. The thirteenth topic introduced biologic data under the heading, paleontologic characters. For example, in a discussion of the paleontologic characters of the Senonian stage, he stated (p. 678) that 81 of the genera represented in that stage are unknown in lower stages, and 42 of the 81 become extinct during the Senonian.

14. The preceding general discussion is followed by a section entitled "Negative characters inferred from the genera." One may paraphrase his discussion by saying: "Here are the genera that do *not* occur in this stage."

15. Positive characters are derived from the *genera* in an analysis of the fossils, either restricted to the stage, or which appear for the first time in the stage. For instance, on p. 679 he gave the names of a number of genera which were born during Senonian time, and of this number 42 genera became extinct before the close of the Senonian age.

16. Paleontologic characters derived from the *species* is the next subject. Usually he gave a list of the most common and characteristic species of the stage, together with illustrations of some of them.

17. The final topic, though sometimes not separately captioned, deals with the geologic history for the age. The French heading is "*Chronologie historique*."

BOUNDARIES OF CRETACEOUS

Progress in the study of the Cretaceous since d'Orbigny's time has resulted in a greater refinement of the stratigraphic classification. Where formerly it was sufficient to delineate the stratigraphic units by stages, biostratigraphers now strive to attain precision down to zones and even to subzones. The growth in the requirements or aims of precision resulted in a critical restudy of the boundaries of the various stratigraphic units.

Little difficulty has been experienced in separating the Cretaceous system from the subjacent Jurassic system in the western Alps, particularly since the time when the uppermost division of the Jurassic, the Tithonian stage, was established by Oppel in 1865. Here the marine strata of the Jurassic system are overlain conformably by the basal Cretaceous beds. Although the Cretaceous ammonites

are not strikingly different from those in Jurassic rocks, nevertheless the distinction of the well exposed fossiliferous strata is possible by paleontologic means. But in many localities the Jurassic-Cretaceous boundary has been the subject of disagreement and the problem is by no means simple.

The problem of the upper boundary of the Cretaceous system in Europe resolves itself essentially into this question: What is the Danian? The age of the Danian beds and their supposed correlatives constitutes one of the greatly disputed problems in stratigraphic geology. Désor, who named the stage, took Faxe,

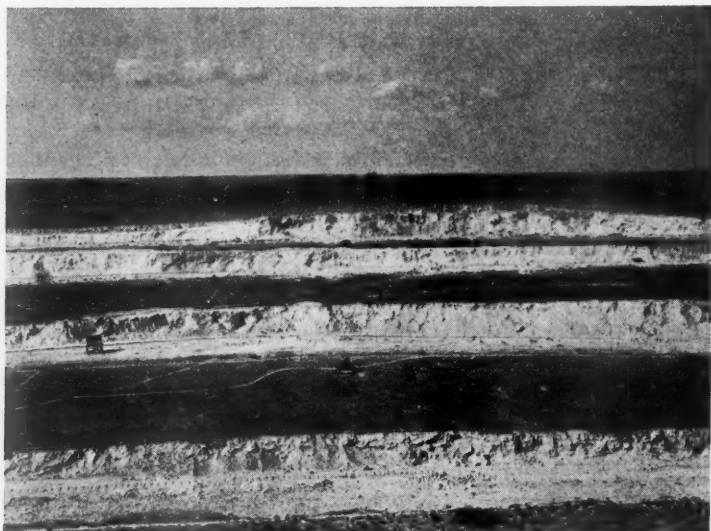


FIG. 5.—View of quarry at Faxe, Denmark; photographed, June 12, 1934.
Type locality of Danian stage.

Denmark, as the type locality. The limestone exposed in the quarry at Faxe (Fig. 5) contains an abundance of hydrocorals, numerous bryozoans, and the mollusks described by Ravn. Not far away, at Stevnsklint, Upper Senonian chalk is overlain by the Danian strata. The dividing line between the rocks of the two stages is not settled, but several workers hold that a disconformity separates the strata of the stages. The upper Danian beds in the type Danian area are often referred to as the "Crania limestone."

Beds in Belgium, France, Africa, and elsewhere have been called Danian, but the evidence for all of the correlations is not entirely convincing. An example will serve to illustrate this boundary problem. In Belgium are some beds called Montian. These have been correlated with the type Danian by several authors and placed in the Cretaceous. Other authorities consider the Montian to be younger than the Faxe limestone, but still Cretaceous. Another school holds a

third view: the Montian is contemporaneous with the Danian, but both are Tertiary. Still others hold that the Montian, being younger than the Faxe limestone, is Tertiary, whereas the Danian is Cretaceous. The upper limit of the Cretaceous system is not settled in Europe, much less so elsewhere.

DIVISIONS OF CRETACEOUS SYSTEM

The chart (Fig. 6) is a preliminary attempt to compile the time-stratigraphic divisions² of the Cretaceous system. One notes that this scheme differs only in details from the arrangement which was established about one hundred years ago by d'Orbigny. Only one new stage (Maestrichtian) has been introduced between the Senonian and the Danian, and the Neocomian has been subdivided. In the present scheme, the writers recommend recognition of two series, the Lower and Upper Cretaceous, as they feel that a tripartite division is less widely used than a two-fold one. The Lower Cretaceous series is divided into the Berriasian, Valanginian, Hauterivian, Barremian, Aptian, and Albian stages. The Upper Cretaceous series is divided into the Cenomanian, Turonian, Senonian, Maestrichtian, and Danian stages. Three substages of the Senonian are accepted as valid, the Coniacian, Santonian, and Campanian substages.

The stages and substages are further subdivided into zones. In the technical stratigraphic sense of the word, zones are thicknesses of strata delimited by paleontologic criteria. Each zone should have regional, if not interregional, application. A distinctive association of species is the criterion for the establishment and recognition of a zone. That is to say, a zone is a thickness of beds containing an assemblage of species such as does not occur in exactly the same combination in the beds above or below. Generally one or more species are restricted to the particular zone, occurring through a part or the whole of it. Certain species occurring in a given zone range into it from the subjacent zone. Other species appear for the first time in the zone and range into the superjacent zone. Some species range throughout the zone and through superjacent and subjacent ones. Only one combination of diagnostic species is found in each zone. In short, a zone is a belt of strata occurring in more than one locality characterized by an association of fossil organisms, one of which is chosen as the index species (or genus). The zonal fossil need not be either confined to its zone or found throughout the zone in all localities.

To give an example of a zone, the writers have drawn upon Spath's recent work on the ammonites of the Gault. They have compiled from his contributions the accompanying graphic analysis (Fig. 7) of the stratigraphic ranges of 165 species, which occur in the uppermost three zones of the Albian stage, namely, the *Euhoplites laevis* zone, the *Mortoniceras inflatum* zone, and the *Stoliczkaia*

² See Schenck and Muller (1941).

³ Otto Haas (1942, p. 65) accepts Roman's proposal in discarding the name *Mortoniceras* using instead *Pervinquerea*. This would mean that the zone would be designated the "*Pervinquerea inflata*" zone. The writers cannot subscribe to this nomenclatural change as it is not in accordance with international rules of zoological nomenclature, for reasons which will have to be explained in another paper.

STANDARD of the CRETACEOUS SYSTEM

SER	STAGES	ZONES and SUBZONES	ZONES BASED ON FOSSILS OTHER THAN AMMONITES		
Upper Cretaceous	DANIAN	(<i>Paraceras danica</i>)		<i>Beloniceras subulius</i>	
	MAESTRICHTIAN	<i>Discocephalites constrictus</i>		<i>Reiphanites striatoidialis</i>	<i>Globotruncana casica</i>
		<i>Bostrychoceras pelagicum</i>			
	CAMPANIAN	<i>Kosmoceras thebaidianum</i>	<i>Belinitella lanceolata</i>		
		<i>Hopliteceras constrictus</i>			
		<i>Bostrychoceras pelagicum</i>			
		<i>Bostrychoceras pelagicum</i>			
		<i>Bostrychoceras pelagicum</i>			
		<i>Bostrychoceras pelagicum</i>			
		<i>Bostrychoceras pelagicum</i>			
	SANTONIAN	<i>Stenoceras goudolupae</i>	<i>Actinoceras quadratus</i>	<i>Offaster pilula</i>	<i>Globotruncana arca</i>
		<i>Stenoceras goudolupae</i>	<i>Actinoceras quadratus</i>	<i>Offaster pilula</i>	<i>Globotruncana arca</i>
	CONIACIAN	<i>Stenoceras goudolupae</i>	<i>Actinoceras quadratus</i>	<i>Offaster pilula</i>	<i>Globotruncana arca</i>
		<i>Stenoceras goudolupae</i>	<i>Actinoceras quadratus</i>	<i>Offaster pilula</i>	<i>Globotruncana arca</i>
	Turonian	<i>Stenoceras goudolupae</i>	<i>Actinoceras quadratus</i>	<i>Offaster pilula</i>	<i>Globotruncana arca</i>
		<i>Stenoceras goudolupae</i>	<i>Actinoceras quadratus</i>	<i>Offaster pilula</i>	<i>Globotruncana arca</i>
	Cenomanian	<i>Stenoceras goudolupae</i>	<i>Actinoceras quadratus</i>	<i>Offaster pilula</i>	<i>Globotruncana arca</i>
		<i>Stenoceras goudolupae</i>	<i>Actinoceras quadratus</i>	<i>Offaster pilula</i>	<i>Globotruncana arca</i>
	Albian	<i>Stenoceras goudolupae</i>	<i>Actinoceras quadratus</i>	<i>Offaster pilula</i>	<i>Globotruncana arca</i>
		<i>Stenoceras goudolupae</i>	<i>Actinoceras quadratus</i>	<i>Offaster pilula</i>	<i>Globotruncana arca</i>
	Maastrichtian	<i>Stenoceras goudolupae</i>	<i>Actinoceras quadratus</i>	<i>Offaster pilula</i>	<i>Globotruncana arca</i>
		<i>Stenoceras goudolupae</i>	<i>Actinoceras quadratus</i>	<i>Offaster pilula</i>	<i>Globotruncana arca</i>

Beloniceras

Reiphanites

Belinitella

Actinoceras

Offaster

Globotruncana

Stenoceras

ALBIAN		NEOCOMIAN		Lower Cretaceous	
ALBIAN	<i>Euglites dentatus</i>	<i>Euglites dentatus</i>	<i>Euglites dentatus</i>	<i>Euglites dentatus</i>	<i>Euglites dentatus</i>
	<i>Bootticeras nuxiiformis</i>	<i>Bootticeras nuxiiformis</i>	<i>Bootticeras nuxiiformis</i>	<i>Bootticeras nuxiiformis</i>	<i>Bootticeras nuxiiformis</i>
	<i>Sommatia tripartita</i>	<i>Sommatia tripartita</i>	<i>Sommatia tripartita</i>	<i>Sommatia tripartita</i>	<i>Sommatia tripartita</i>
	<i>Leontella lundbergi</i>	<i>Leontella lundbergi</i>	<i>Leontella lundbergi</i>	<i>Leontella lundbergi</i>	<i>Leontella lundbergi</i>
APTIAN	<i>Acrochordites jacobii</i>	<i>Acrochordites jacobii</i>	<i>Acrochordites jacobii</i>	<i>Acrochordites jacobii</i>	<i>Acrochordites jacobii</i>
	<i>Cheloniceras subdecastratum</i>	<i>Cheloniceras subdecastratum</i>	<i>Cheloniceras subdecastratum</i>	<i>Cheloniceras subdecastratum</i>	<i>Cheloniceras subdecastratum</i>
	<i>Cheloniceras nortoni</i>	<i>Cheloniceras nortoni</i>	<i>Cheloniceras nortoni</i>	<i>Cheloniceras nortoni</i>	<i>Cheloniceras nortoni</i>
	<i>Dichagmites denyseni</i>	<i>Dichagmites denyseni</i>	<i>Dichagmites denyseni</i>	<i>Dichagmites denyseni</i>	<i>Dichagmites denyseni</i>
BARREMIAN	<i>Cottidius recticostatus</i>	<i>Cottidius recticostatus</i>	<i>Cottidius recticostatus</i>	<i>Cottidius recticostatus</i>	<i>Cottidius recticostatus</i>
	<i>Reteceras uliciformis</i>	<i>Reteceras uliciformis</i>	<i>Reteceras uliciformis</i>	<i>Reteceras uliciformis</i>	<i>Reteceras uliciformis</i>
	<i>Proceroceras serrici</i>	<i>Proceroceras serrici</i>	<i>Proceroceras serrici</i>	<i>Proceroceras serrici</i>	<i>Proceroceras serrici</i>
	<i>Pseudobuccella angulicostata</i>	<i>Pseudobuccella angulicostata</i>	<i>Pseudobuccella angulicostata</i>	<i>Pseudobuccella angulicostata</i>	<i>Pseudobuccella angulicostata</i>
HAUTERIVIAN	<i>Abeggeella cogli</i>	<i>Abeggeella cogli</i>	<i>Abeggeella cogli</i>	<i>Abeggeella cogli</i>	<i>Abeggeella cogli</i>
	<i>Criceras diuilli</i>	<i>Criceras diuilli</i>	<i>Criceras diuilli</i>	<i>Criceras diuilli</i>	<i>Criceras diuilli</i>
	<i>Acneceras radiata</i>	<i>Acneceras radiata</i>	<i>Acneceras radiata</i>	<i>Acneceras radiata</i>	<i>Acneceras radiata</i>
	<i>Ellenella subradiata</i>	<i>Ellenella subradiata</i>	<i>Ellenella subradiata</i>	<i>Ellenella subradiata</i>	<i>Ellenella subradiata</i>
VALANGINIAN	<i>Polystrophia polygona</i>	<i>Polystrophia polygona</i>	<i>Polystrophia polygona</i>	<i>Polystrophia polygona</i>	<i>Polystrophia polygona</i>
	<i>Platystrophia heteroploma</i>	<i>Platystrophia heteroploma</i>	<i>Platystrophia heteroploma</i>	<i>Platystrophia heteroploma</i>	<i>Platystrophia heteroploma</i>
	<i>Thurmannella boissieri</i>	<i>Thurmannella boissieri</i>	<i>Thurmannella boissieri</i>	<i>Thurmannella boissieri</i>	<i>Thurmannella boissieri</i>
	<i>Prodactoceras collistoides</i>	<i>Prodactoceras collistoides</i>	<i>Prodactoceras collistoides</i>	<i>Prodactoceras collistoides</i>	<i>Prodactoceras collistoides</i>
BERRIASIAN	<i>Bootticeras nuxiiformis</i>	<i>Bootticeras nuxiiformis</i>	<i>Bootticeras nuxiiformis</i>	<i>Bootticeras nuxiiformis</i>	<i>Bootticeras nuxiiformis</i>
	<i>Cheloniceras subdecastratum</i>	<i>Cheloniceras subdecastratum</i>	<i>Cheloniceras subdecastratum</i>	<i>Cheloniceras subdecastratum</i>	<i>Cheloniceras subdecastratum</i>
	<i>Cheloniceras nortoni</i>	<i>Cheloniceras nortoni</i>	<i>Cheloniceras nortoni</i>	<i>Cheloniceras nortoni</i>	<i>Cheloniceras nortoni</i>
	<i>Dichagmites denyseni</i>	<i>Dichagmites denyseni</i>	<i>Dichagmites denyseni</i>	<i>Dichagmites denyseni</i>	<i>Dichagmites denyseni</i>

Compiled by Thomas W. Miller and Robert G. Schuch for distribution at the A.A.P.G. meeting, Denver, April, 1941.
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FIG. 6.—Series, stages, substages, zones, and subzones of Cretaceous system; provisional arrangement.

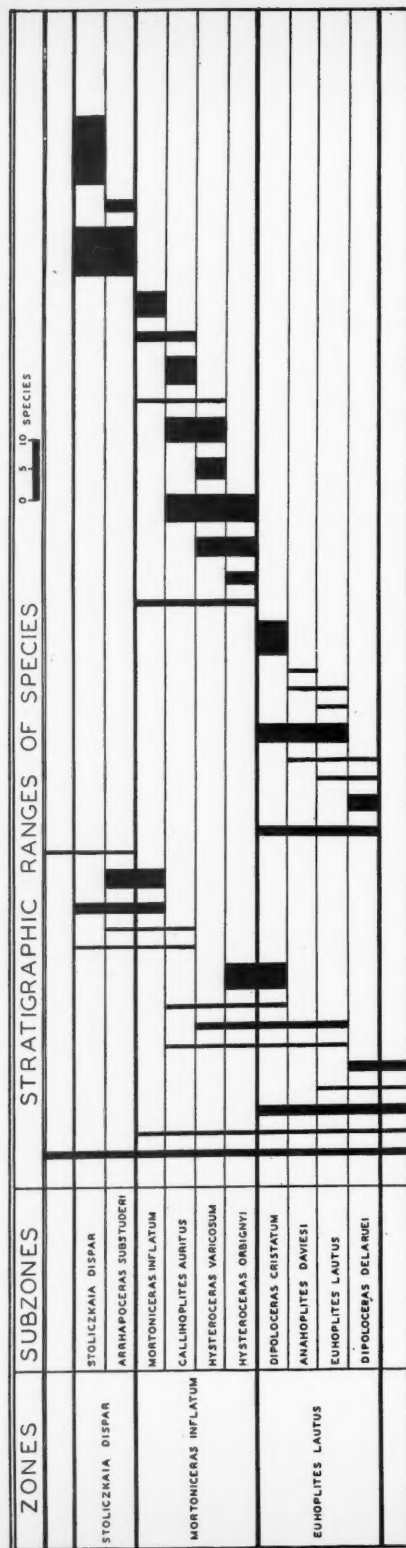


FIG. 7.—Analysis of stratigraphic ranges of ammonite species of upper three zones of Albian stage.

dispar zone. The stratigraphic ranges of species are shown by the vertical black bands the widths of which are proportional to the number of species that have that particular range.

It will be noticed that there are several species which occur in all the three zones considered here, as well as in the overlying Cenomanian rocks and in the subjacent zones. Other species occurring in the subjacent zone range upward through a part of the *Euhoplites lautus* zone; some extend clear to the top of it, and one species ranges through the two lower zones and part way into the uppermost, the *Stoliczkaia dispar* zone. The next group of species straddles the boundary between the two lower zones, extending variable distances up and down in each of them. The third group crosses the boundary between the upper two zones, one species begins at the base of the *dispar* zone and crosses the Lower-Upper Cretaceous boundary into the Cenomanian stage. These three groups of species range across the zone boundaries. Farther to the right on the chart are shown the ranges of species which are restricted to the *E. lautus* zone. Three of these range through the entire zone, whereas others are of more limited distribution. The zonal fossil itself, *Euhoplites lautus*, is reported from only the two middle subzones. It is not found near the base nor at the top of the zone. The remaining range-lines of the species which are restricted to the zones show essentially the same type of distribution.

The subzones are divisions of the zones. They are recognized by the same criterion—an association of fossil organisms. The *Callihoplites auritus* subzone of the *Mortonicerias inflatum* zone serves as an example. Several species are restricted to it; others have their upper limits of range in it; some appear in the subzone for the first time and range into the superjacent subzone; and, finally, many species occur in the subzone and in the subjacent and superjacent subzones as well.

The inquiring stratigrapher will ask at this juncture whether any of these zones have been recognized in any locality other than the type areas. Strata which fall in the *Mortonicerias inflatum* zone have been recognized in widely separated districts, such as England, France, Germany, Africa, and Texas. The same holds true for the *Stoliczkaia dispar* zone. The *Euhoplites lautus* zone has been recognized at least in England and Germany, and is probably also present in many other places. The conclusion is that the zones are not just divisions of a local section but are time-stratigraphic units of regional or interregional extent.

CONCLUSION

The chief purpose of this paper has been to present the total or standard section of the Cretaceous system as it is known today. A brief record of the growth of the standard serves to place it in proper historical perspective. An explanation has been given of its basic component part—the zone. This investigation has raised a number of questions which could not be answered in the limited time available. A brief discussion of some of these questions will show that there is ample opportunity for research on the Cretaceous.

One question arises in connection with the use of the word Cretaceous and its equivalents. Their reading of the literature leads the writers to believe that the word grew in a natural way from the every-day expression of the layman to the technical expression of the scientist. They are therefore not positive whether they have referred to the first definition of the Cretaceous system, and they feel that further pursuit of the origin of the name would be a sterile bibliographic exercise. More fruitful is an inquiry into how the standard grew to its present status. A name, which is used as a symbol for a thing, is important only insofar as the same name means the same thing to the different people. Thus, although they do not place unbalanced emphasis upon priority in stratigraphic nomenclature and although they think that original definitions must be weighted against usage, the writers submit that uniform usage of technical terms is conducive to mutual understanding.

An example showing how different uses of the same term may lead to confusion can be found in recent publications. Reed (1941, pp. 108-09) placed the boundary between the Upper and Lower Cretaceous within the Albian stage, presumably because of the presence of an unconformity at that stratigraphic position in California. On the other hand, Stephenson *et al.* (1942, p. 442) follow the practice of the United States Geological Survey, and place Lower-Upper Cretaceous boundary within the Cenomanian stage "as a matter of convenience," being influenced by the presence of an unconformity in the Texas section. As can be seen from the standard of the Cretaceous system (Fig. 6), most European geologists and not a few in America place this boundary between the Cenomanian and Albian stages. What then will such an expression as "at the close of the Lower Cretaceous" mean?

Another consideration is that of the type locality of the Cretaceous system. As far as the writers can tell, the system has no one spot as its type; the area shown on the map by d'Omalius d'Halloy is the type area. This is "type by subsequent designation" for the reason that the early workers had no idea that their successors would be exacting in their demands for definitions. These pioneers did not foresee that some later workers would hold the view that strata older or younger than those exposed in the type section should be excluded from the particular stratigraphic unit.

A third question is this one: should time-stratigraphic units be related to unconformities? The writers' stand on this matter is that they need not be so related, and that if a system, series, stage, or zone boundary happens locally to coincide with an unconformity, it is purely coincidental. Instead, such time-stratigraphic units are best set up in sections where each unit is conformably underlain and overlain by the immediately adjacent units. If a time-stratigraphic unit boundary happens to coincide with the boundary of a lithogenetic unit (formation), that again is purely coincidental.

Further research on the standard of the Cretaceous is needed to settle a fourth question: what is the relation between the zones based on the *Cephalopoda* and those founded on fossils other than ammonites? The right column of Figure 6 shows a manifestly provisional zonation using the Foraminifera. Fine-spun divi-

sions of the Upper Cretaceous by use of microfossils are possible, but where small units have been set up locally, the results are either unpublished or no attempt has been made to fit them into the "ammonite scale."

Scores of other questions, many of them matters of detail, need study. The nomenclature of numerous species and genera is in an unsatisfactory state. Several diagnostic species are as yet unnamed. Some of the zones and especially the subzones need to be tested to determine if they are true zones, or teilzones, or biozones, or simply horizons.

Conservatively estimated, more than 5,000 publications deal with the subject of the Cretaceous stratigraphy and paleontology, and to catalog and index them all would require more time than could be devoted to the task. Presented here, therefore, is only a short list of selected references, many of which contain more complete bibliographies.

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UPPER CRETACEOUS STRATIGRAPHY OF WEST SIDE OF
SACRAMENTO VALLEY SOUTH OF WILLOWS,
GLENN COUNTY, CALIFORNIA¹

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ABSTRACT

This article discusses the lithology of the Upper Cretaceous sediments (Chico series) along the west side of Sacramento Valley, as displayed in a series of measured and examined surface sections between Winters, Yolo County, and Willows, Glenn County. Certain recognizable lithologic units on the outcrop are briefly described, defined, and named as a step toward the breakdown of the thick Chico series into formations adaptable for use in this region. These formational units in descending order are as follows: Forbes formation, Guinda formation, Funks formation, Sites formation, Yolo formation, and Venado formation.

Relationship between measured sections, as well as variation in the sections, is discussed and shown by means of correlation charts and drawings.

INTRODUCTION

The literature of the Cretaceous sediments in California is in no sense voluminous or exhaustive, as compared with that of the Tertiary. This fact may be readily understood since the greater part of the Tertiary studies have been made in connection with the search for oil in various parts of California. The discovery of oil in late Upper Cretaceous beds in the vicinity of Coalinga in the early period of San Joaquin Valley's oil history was apparently so overshadowed by more prolific discoveries in sediments of Tertiary age that much of its possible significance was lost.

It was only during the early part of the decade just past that serious attention was turned toward the Cretaceous sequence of sediments as a possible future source of oil or gas. This attention was prompted in part by the discovery of commercial quantities of marketable dry gas by the Amerada Petroleum Corporation near Tracy, San Joaquin County (Sec. 15, T. 2 S., R. 5 E., M. D. B. & M.), but perhaps to a larger extent by a general recognition of the pressing need for new oil reserves to reverse the downward trend of oil discovery rates in other parts of California. That the Sacramento Valley region should have received a substantial part of this attention was inevitable, since the exposed west side sections constitute some of the thickest, most continuous and extensive known in California.

A brief history of early exploration in the Sacramento Valley region, bearing on the recognition and definition of rocks of Cretaceous age, has been discussed by Taff, Hanna, and Cross³ and is not repeated here. It is sufficient to state

¹ Read before the Pacific Section of the Association at Los Angeles, October 16, 1941, and before the Association at Denver, April 22, 1942. Manuscript received, April 27, 1942. Published by permission of Standard Oil Company of California.

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³ J. A. Taff, G. D. Hanna, and C. M. Cross, "Type Locality of the Cretaceous Chico Formation," *Bull. Geol. Soc. America*, Vol. 51, No. 9 (September, 1940), pp. 1311-15.

that the name "Chico group" was first proposed by Gabb⁴ in 1869, in referring to sediments exposed in Chico Creek, at Pence's Ranch, and at Tuscan Springs. Formal designation of the Chico Creek occurrence as the type locality of the Chico group was made by Stanton in 1896⁵ and this designation has been generally accepted by subsequent workers with the Upper Cretaceous in northern California.

There is little doubt that many writers on the Upper Cretaceous have broadened the original scope of the term "Chico group" to include beds of various ages not represented at the type locality on Chico Creek in Butte County. F. M. Anderson, in a recent paper,⁶ has elected to use the term "Chico" in a series sense to include all known Upper Cretaceous sediments in California, ranging in age from Danian into upper Albian. He further subdivides his Chico series into Moreno, Panoche, and Pioneer groups, in descending order, and these groups into stages, based on the vertical distribution of faunas collected and studied from many localities in the San Joaquin and Sacramento valleys and elsewhere on the Pacific Coast. Anderson postulates a strong hiatus separating the Chico series from the underlying Shasta series (Lower Cretaceous) and recognizes the possibility of further unconformities or disconformities within the Chico series which may be defined when the stratigraphy and history of the Upper Cretaceous period is better understood.

N. L. Taliaferro⁷ has chosen to discard the term "Chico" entirely, because of the general confusion attached to its present usage. He would substitute a two-fold division of the Upper Cretaceous, based on evidence of a strong orogenic disturbance in middle Upper Cretaceous time as disclosed by studies in the Santa Lucia Range and other parts of the central Coast Ranges. Taliaferro's upper division, or "Asuncion group," would include F. M. Anderson's Moreno and Panoche groups, with an age range from Danian through Senonian. His lower, or "Pacheco group," would be equivalent to Anderson's Pioneer group, with an age range from Turonian through upper Albian.

Except for a difference of opinion regarding the usage of the term "Chico," as noted in the preceding paragraphs, the conclusions reached by these two authors as to the geological history of the Upper Cretaceous are not markedly dissimilar. Neither are they at variance with the observations made by the writer of this paper, except as to certain points which will be discussed later. These points of exception deal chiefly with the evidence of strong orogenic disturbances within the Upper Cretaceous sequence of sediments and of the relationship between the Upper and Lower Cretaceous. The conclusions, insofar as they differ from the broader conclusions of Taliaferro and Anderson, are doubtless of local application and reflect only local environment and conditions of deposition.

⁴ *Geol. Survey California, Paleontology*, Vol. 2 (1869), pp. xiii, xiv, 129, footnote.

⁵ "The Faunal Relations of the Eocene and Upper Cretaceous on the Pacific Coast," *U. S. Geol. Survey 17th Ann. Rept.*, Pt. 1 (1896), p. 1017.

⁶ F. M. Anderson, *California Div. Mines Bull.* 118, Pt. 2 (1941), pp. 183-86.

⁷ N. L. Taliaferro, *ibid.*, Pt. 2 (1941), pp. 130-34.

STRATIGRAPHY OF CHICO SERIES

GENERAL STATEMENT

The writer's usage of the term "Chico series" reflects a preference for the retention of the name in the region wherein it was first applied. The scope of the term as herein applied conforms to that established by F. M. Anderson in that it includes all Upper Cretaceous sediments exposed along the west side of Sacramento Valley and elsewhere in California. Any further breakdown of the series into groups and stages in the area under discussion has been made impossible by the general absence of adequate fossil material, on the basis of which such further subdivision must be made. It seems certain, however, that both the Pioneer and Panoche groups of F. M. Anderson (Pacheco and lower Asuncion groups of N. L. Taliaferro) are represented along the west side of Sacramento Valley. The Moreno group (and its equivalent, the upper Asuncion group) has not been found within the area under discussion, nor at any locality elsewhere in Sacramento Valley.

On first contact with exposures of Upper Cretaceous (Chico series) sediments along the west side of Sacramento Valley, one is impressed first by the great, apparently uninterrupted thickness of exposed sections; second, by the monotonous succession of alternating sandstones and siltstones or shales; and, third, by the remarkable similarity from top to base of recurrent sediments of any particular lithologic type. The wide vertical and lateral distribution of such physical attributes as color, carbonaceous content, and mineralogical assemblages points to the maintenance of conditions of source and depositional environment throughout a tremendous period of time. That these conditions were not fixed or always of uniform character is indicated by the cyclic recurrence of fine and coarse sediments in well marked zones, as well as by the phenomenon of rhythmic banding of one lithologic type with minor amounts of the other within the zones themselves. The phenomenon of rhythmic banding has been attributed by some writers to seasonal or climatic cyclic influences. The broader division of the sedimentary section into relatively thick alternations of fine and coarse sediments can only be attributed to more far-reaching changes in climate, or in elevation, or character of the hinterland, or to a combination of these.

The sediments of the Chico series on the west side of Sacramento Valley reflect these varying degrees of change in conditions with their resultant division of the stratigraphic succession into fairly sharply defined lithologic units which on the outcrop can be followed and mapped for many miles.

NEW FORMATIONAL UNITS PROPOSED

A recognition of the occurrence of cartographic units of wide distribution within the Chico series of sediments on the west side of Sacramento Valley forms the basis for the new formational names proposed. The proposal is made with the thought that the use of such a series of formational units which can be widely recognized will be of practical advantage to the field geologist, and will greatly facilitate the handling of a thick, bulky sequence of sediments.

Field mapping in preparation of this proposal extends over a period of 10 years, during which time the various units here mentioned have been traced and recognized along the outcrop between Vacaville on the south and Willows on the north. The evidence bearing on this problem is presented in the form of a series of five plane-table traverses showing the succession of beds measured and described, together with a graphic, structural cross section and derived columnar section for each traverse.

Some of the formational units of the Chico series discussed have already been named and briefly described by the writer in other papers dealing with the west side of Sacramento Valley.⁸

In descending order they are as follows.

1. Forbes formation (chiefly shale and siltstones with minor thin sandstones)
2. Guinda formation (chiefly massive to bedded concretionary sandstone with minor shale bands)
3. Funks formation (chiefly shale and siltstone)
4. Sites formation (chiefly massive to bedded concretionary sandstone with minor siltstone breaks)
5. Yolo formation (chiefly siltstone)⁹
6. Venado formation (chiefly massive to bedded concretionary sandstone or rhythmically banded sandstone with minor shale breaks)¹⁰

Forbes formation.—The type locality of the Forbes formation is on the crest and east flank of Rumsey Hills, T. 12 and 13 N., R. 3 W., Yolo County. The best sections exposed are in Salt Creek in and adjacent to Section 34, T. 13 N., R. 3 W., where approximately 1,300 feet of beds belonging to this formation are exposed below the Tehama gravels (upper Pliocene), in Petroleum Creek, Secs. 11 and 15, T. 12 N., R. 3 W., where approximately 1,875 feet of beds are exposed, and in Dunnigan Creek, Secs. 35 and 36, T. 12 N., R. 3 W., where 3,000 feet, more or less, of beds are assigned to this formation.

In this area the Forbes formation consists for the most part of soft, well bedded to massive light greenish gray to gray carbonaceous siltstones and silty shales, with here and there thin beds of fairly soft, fine- to coarse-grained or pebbly sandstone. The pebbly beds are characterized by the presence of rounded fragments of dense gray to tan limestones which were probably derived from the erosion of older Cretaceous beds on the west. At the base of the formation on the crest of Rumsey Hills and in the headwaters of Salt Creek is a 250-300-foot band of gray or bluish gray clay shale containing many odd-shaped gray or tan fos-

⁸ "Rumsey Hills Anticline, Yolo and Colusa Counties, California," and "Sites Anticline, Glenn and Colusa Counties, California," *California Div. Mines Bull. 118*, Pt. 3 (in press).

⁹ Yolo formation replaces the pre-occupied name "Mills formation," as used in references shown in footnote 8.

¹⁰ Venado formation replaces the pre-occupied name "Golden Gate formation," as used in references in footnote 8.

siliferous limestone concretions. Locally, a thin limestone layer is present at the base of the formation immediately above the underlying Guinda formation. This lower shale zone is characterized further by a well preserved foraminiferal fauna in which the form *Marginulina jonesi* is common and apparently diagnostic.

Although the Forbes formation is predominantly a shale or siltstone unit, it contains in many places relatively thin or areally restricted sandstone beds. Some of these sandstone beds, as well as the shales in which they are found, contain marine mollusks. The vertical range of the foraminiferal fauna containing *Marginulina jonesi* is apparently variable and ranges from a few hundred feet at the base of the formation in the Rumsey Hills area to 3,000 feet in the Standard Oil Company of California's Peter Cook well No. 1, Sec. 31, T. 12 N., R. 1 W., Yolo County. The variations observed are apparently related to local variations of the formation from dominantly shale to dominantly siltstone, the latter facies commonly showing the presence of only an arenaceous foraminiferal fauna.

The Forbes formation is commonly the youngest member of the Upper Cretaceous Chico series found along the west side of the valley, but a wide geographic distribution beneath the valley floor is indicated by the presence of shales with a *Marginulina jonesi* fauna in deep wells near Marysville Buttes, Sutter County, near Corning, Tehama County, and near Willows, Glenn County. That Upper Cretaceous sediments younger than the Forbes formation are present beneath the valley floor in the northern part of Sacramento Valley, and which, because of their lithologic character should be excluded from this formation, is suggested by the records of the Ohio Oil Company's Willard No. 1, Sec. 18, T. 20 N., R. 2 W., Glenn County, the Amerada Petroleum Corporation's C.L.I. No. 1, Sec. 34, T. 16 N., R. 1 W., Colusa County, and the various deep wells of Buttes Oilfields, Inc., T. 15 N., R. 1 E., Sutter County, where the youngest Cretaceous sediments encountered are predominantly sandstone and should probably bear a separate formational designation. As these younger beds, however, are not known with certainty to crop out along the west side of Sacramento Valley, they are not included in this discussion.

Guinda formation.—Conformably below the basal foraminiferal shale member of the Forbes formation in the Rumsey Hills area there is an exposed section of 1,000 feet, more or less, of Upper Cretaceous sediments to which the name Guinda formation has been applied. Typical exposures are present in the headwaters of Petroleum and Salt creeks in the central and north central parts of T. 12 N., R. 3 W., Yolo County, and along the faulted western slope of Rumsey Hills, between the latitudes of the town of Rumsey on the north and Tancred Siding (abandoned) on the south. As exposed at these localities, the Guinda formation consists primarily of massive to well bedded, fine- to medium-grained, gray to buff-weathering concretionary sandstone. Near the middle part of the exposed section is an interval containing numerous relatively thin beds of gray, carbonaceous shale and siltstone containing rounded limestone concretions and here

and there thin beds of fine-grained, flaggy sandstone. The aggregate thickness of this shale zone is approximately 150 feet.

The basal sandstone beds of the Guinda formation are not exposed in the vicinity of the type locality in Rumsey Hills but were penetrated at a relatively shallow depth in the Standard Oil Company of California's Tippetts 2-1, Sec. 9, T. 12 N., R. 3 W., and Tippetts 1-1, Sec. 15, T. 12 N., R. 3 W. The thickness of the formation from surface exposures and well information is known within close limits, therefore, and placed at 1,400 feet.

The Guinda formation has been recognized in all the surface sections which have been examined in connection with this discussion between Putah Creek, Yolo County, and Logan Creek, Glenn County. Throughout this distance it maintains a fairly uniform lithologic character, although the thickness of the unit decreases in a northerly direction. In those sections where the Guinda formation forms the highest lithologic unit exposed along the west side of the valley, the decreased thickness can be attributed to pre-upper Pliocene or recent erosion. The general decrease in thickness of this member from south to north is apparently coupled with a tendency for similar thinning in an easterly direction beneath the valley floor, since deep wells at Marysville Buttes and near Willows and Corning have failed to show any appreciable thickness of sand at the horizon where the Guinda formation should normally occur. On the basis of this evidence we may postulate a southwesterly source for the material comprising the Guinda formation.

Funks formation.—Typical exposures of the Funks formation have been previously described by the writer from the vicinity of Stone Corral Creek, particularly in the W. $\frac{1}{2}$ of Sec. 27, T. 17 N., R. 4 W., and along the course of Funks Creek, particularly in the W. $\frac{1}{2}$, Sec. 10, T. 17 N., R. 4 W., Colusa County. On Stone Corral Creek (Fig. 5) the Funks formation lies conformably below sandstones of the Guinda formation and consists for the most part of greenish gray clay shale and siltstone. The thickness exposed is approximately 620 feet but in exposed sections on the south the thickness is known to reach 2,500 feet.

Beyond the fact that this formation is known to appear in varying thickness at all the surface sections examined along the west side of Sacramento Valley, little is known as to its geographic distribution beneath the floor of Sacramento Valley. The only record of its subsurface distribution is gained from the examination of cores from the Buttes Oilfields, Inc., Buttes well No. 6, Sec. 1, T. 15 N., R. 1 E., where samples presumably from between the depths of 7,073 and 7,402 feet revealed a foraminiferal fauna similar in many respects to that found in the Funks formation on the outcrop. In general, however, the calcareous Foraminifera are neither as abundant nor as well preserved as those found in the Forbes formation but the unit is characterized by an abundance of Radiolaria.

Sites formation.—The Sites formation was named from exposures found both north and south of Stone Corral Creek, particularly in the E. $\frac{1}{2}$ of Sec. 33 and

the E. $\frac{1}{2}$ of Sec. 28, T. 17 N., R. 4 W., Colusa County. At this, as well as at other localities examined, the Sites formation conformably underlies shales or siltstones of the Funks formation and conformably overlies the siltstones and shales of the Yolo formation. It consists for the most part of massive to well bedded or rhythmically banded, concretionary, greenish gray or light drab sandstone. In the bedded portions of the formation, thin greenish gray carbonaceous siltstone breaks are common. Fossils in this dominant sandstone unit are rare or fragmentary in their occurrence and so far as known have never been adequate to place specifically the Sites formation in any of the faunal stages as set up by F. M. Anderson.

The Sites formation reaches its greatest development in the southern part of the area under discussion. In Putah Creek, T. 8 N., R. 2 W., Yolo County, a thickness of 3,965 feet was measured. In a northerly direction the thickness progressively decreases until at the latitude of Logan Creek, T. 19 N., R. 4 W., Glenn County, only 125-150 feet of sandstone is observed to separate the overlying Funks formation from the underlying Yolo formation. Beyond this point the sandstones continue to diminish in thickness and within a very few miles disappear completely, bringing the overlying and underlying shales together as a single unbroken unit.

Knowledge regarding the distribution of the Sites formation is limited to the present extent of the formation as exposed along the west side of Sacramento Valley. The Nigger Heaven Oil and Gas Company's Lee Bow No. 1, Sec. 22, T. 12 N., R. 3 W., Yolo County, penetrated 2,539 feet of this formation in the interval from 2,681 feet to 5,220 feet. However, the proximity of this well location to the exposures of the Sites formation along the west side of the valley does not add materially to the information regarding its distribution. Other deep wells along the western edge of Sacramento Valley from Woodland, Yolo County, to Corning, Tehama County, have apparently not been drilled deep enough to reach this member. The Buttes Oilfields, Inc., Buttes No. 6, Sec. 1, T. 15 N., R. 1 E., Sutter County, drilled a conglomerate section between the depths of 7,402 and 7,650 feet, underlying shales and siltstones which may belong to the Funks formation. This conglomerate may therefore represent an eastern shore-line facies of the Sites formation, a conclusion based entirely upon its relative stratigraphic position (Fig. 8).

Yolo formation.—The Yolo formation is so named because of its widespread distribution along the west side of the Sacramento Valley in Yolo County. Good exposures of this shaly member are ordinarily confined to road cuts and stream beds in the area under discussion. The formation expresses itself in the topography as low, rounded hills without exposures. Probably the best exposed section of the Yolo formation is found at Cache Creek, immediately downstream from the new concrete bridge on the Rumsey-Lake County highway. At this locality, and at all other localities observed in connection with this study, the Yolo forma-

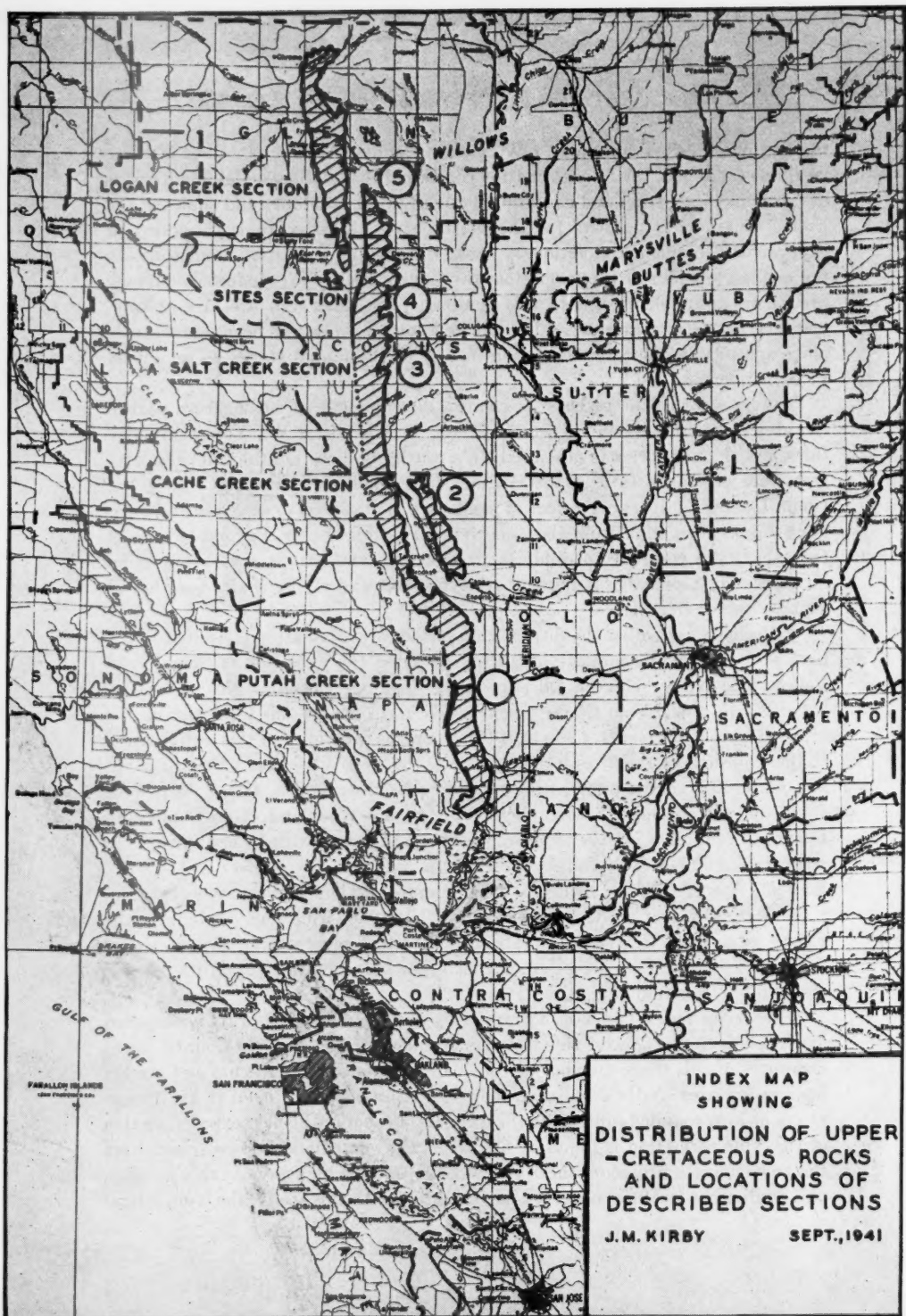


FIG. 1.—Index map, showing general distribution and locations of measured sections of Upper Cretaceous sediments along west side of Sacramento valley.

tion is observed to underlie conformably the sandstones of the Sites formation and conformably overlie sandstones of the Venado formation. This conformable relationship is maintained throughout the area.

Wherever observed, the Mills formation consists of well bedded, greenish gray or light drab siltstones with numerous thin layers of fine flaggy sandstone. In many sections, the lower few feet of the formation becomes rhythmically banded with thin layers of hard, fine sandstone, the sandstone increasing in relative abundance down to the top of the underlying Venado sandstone member. The contact as placed is, therefore, gradational and represents the horizon at which dominant siltstone gives way to dominant sandstone.

The same statements may be made with regard to the distribution of the Yolo formation as were made in the case of the overlying Sites formation. Information regarding its distribution is limited to the known exposures along the west side of Sacramento Valley. Deep wells drilled beneath the Sacramento Valley floor have not recorded the presence of this formation, primarily because of insufficient stratigraphic penetration. The thicknesses recorded in the various measured sections described herein range from 500 to 1,100 feet, with the thinner sections developed in the northern part of the area.

Venado formation.—The Venado formation was named from the village of Venado (Mountain House), which is located in the immediate vicinity of prominent exposures of this formational unit in the NE. $\frac{1}{4}$ of Sec. 19, T. 5 N., R. 4 W., M.D.B.M., Colusa County. The type locality of this formation has been previously described as lying in Sec. 9, T. 17 N., R. 4 W., Colusa County.¹¹ At this locality, the Venado formation forms a prominent sandstone rimrock along the east flank of the Sites anticline. Comparable thicknesses and exposures are found along the entire western margin of the Sacramento Valley from the latitude of Winters, Yolo County, to that of Willows, Glenn County. The most accessible sections are found along the various roads which traverse the frontal mountain range from the Sacramento Valley to the interior.

The Venado formation is predominantly sandstone with only minor amounts of siltstone and shale and here and there conglomerate layers at various levels but particularly at or near the base of the formation. Throughout the length of the exposures mapped, the formation forms prominent strike ridges in the topography, in sharp contrast to the valleys, swales, and low ridges cut in the broad exposures of the underlying shales and siltstones of the Shasta series of Lower Cretaceous age.

The top of the Venado formation is placed at the horizon where the prominent sandstone beds grade rather abruptly into the thinly bedded flaggy sandstones and siltstones of the Yolo formation. The base of the formation is marked in most places by an abrupt change from sandstone to siltstone of the underlying Shasta

¹¹ J. M. Kirby, "Sites Anticline, Glenn and Colusa Counties, California," *California Div. Mines Bull.* 118, Pt. 3 (in press).

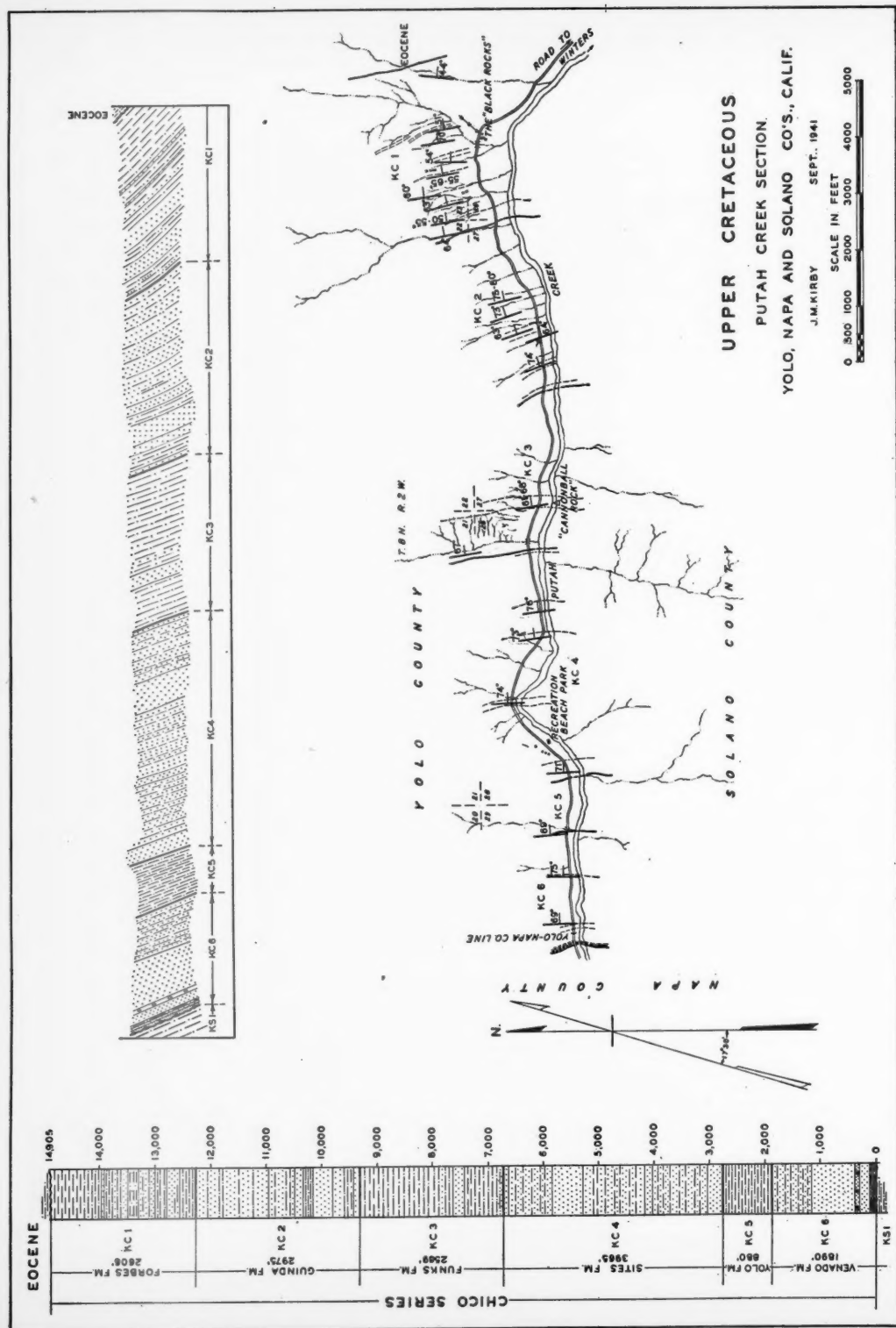


FIG. 2.—Putah Creek section, Yolo, Napa, and Solano counties, California.

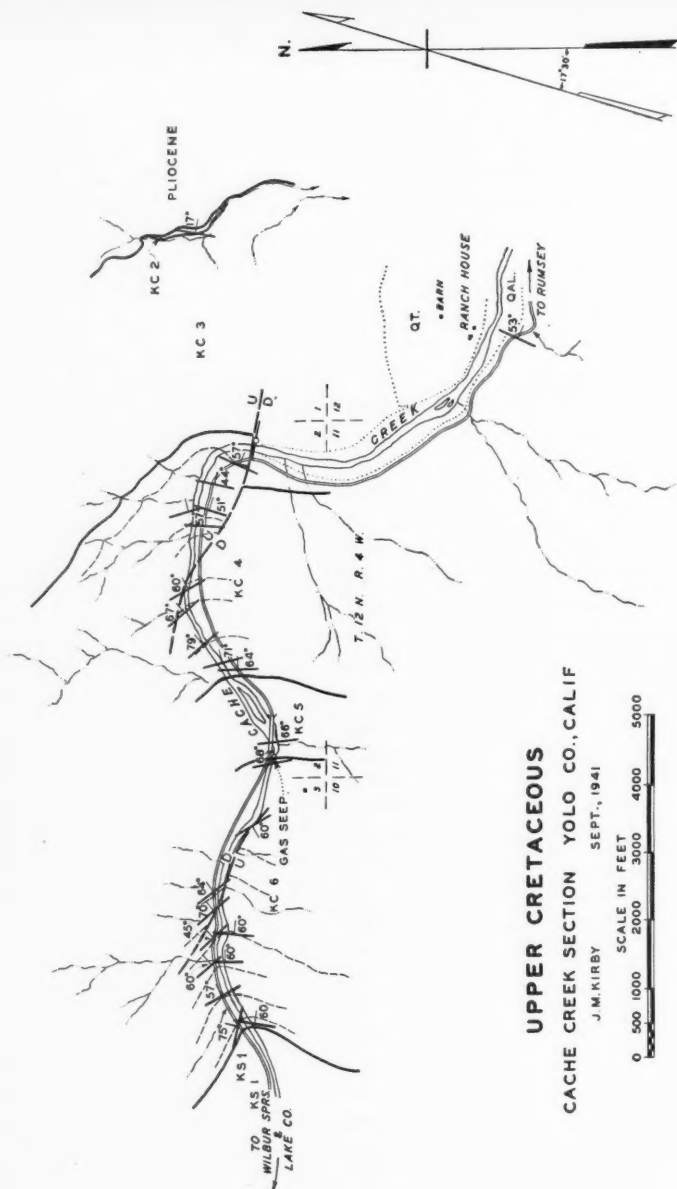
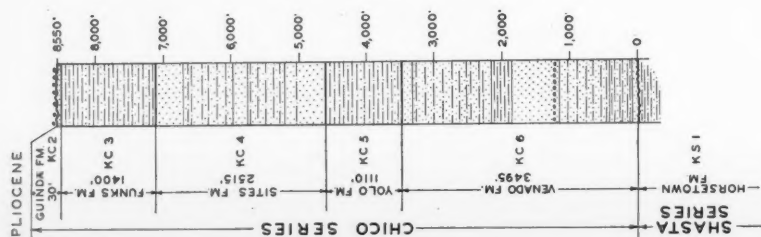
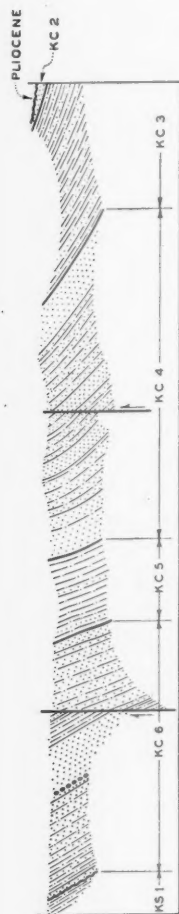
series. At some localities, thin conglomerate lenses or layers appear at or immediately above the base of the Venado formation. In others, the contact appears to be no more abrupt than, or essentially of a different character from, that observed between sandstone and siltstone formations at other levels in the Upper Cretaceous section. There appears to be no great structural discordance or specific evidence of a great hiatus separating the Chico and Shasta series within the greater part of the area under discussion. This is particularly true of those sections north of Putah Creek, Yolo, Napa, and Solano counties. At the last locality, however, a rather thick conglomerate layer immediately overlies the siltstone of the Shasta series, and thinner lenses of conglomerate or gritty sandstone are common in the lower several hundred feet of the Venado formation. Rounded pebbles or cobbles of a great variety of rocks, including granite, porphyritic volcanics, dense limestone, and other Cretaceous rocks are present in this basal member. Coupled with this is a pronounced reduction in thickness of the succession of coarser clastics comprising the Venado formation as compared with sections measured on the north. This thinning apparently continues in a southerly direction from Putah Creek and may reflect the presence of a pre-Venado uplift in east-central Napa County, against which the lower sediments of the Chico series overlapped. Detailed mapping of beds both above and below the Chico-Shasta series contact will be necessary to demonstrate the time break and period of uplift and erosion which have been recognized as having taken place at this time horizon in other parts of California.

It is assumed from the evidence available that the sediments of the Shasta and Chico series are essentially parallel and that the orogenic forces which came into play at the end of Shasta time acted in an area some distance west and that the effects of this orogeny were reduced to a minimum in the area under discussion. In all probability, the sediments examined represent detrital accumulation in the deepest part of the Upper Cretaceous basin of deposition, and the western extension of this basin, which was the part subjected to pre-Chico orogeny, has been removed by erosion.

DISCUSSION OF MEASURED SECTIONS

The data on the thickness, character, distribution, and correlation of the various formations comprising the Chico series of sediments are based on the comparison of a series of five measured sections along the west side of Sacramento Valley between Putah Creek, Yolo County, and Logan Creek, Glenn County.

Putah Creek section, Yolo, Napa, and Solano counties.—This is the southernmost of the series of sections examined in connection with this discussion. The section measured follows the course of Putah Creek from a point along the Winters to Monticello highway, known as the "Black Rocks," to the Yolo-Napa County line. The highest beds of the Chico series exposed in the vicinity of the Black Rocks belong to the Forbes formation, which is here overlain unconformably by glauconitic shales of the Capay formation (middle Eocene). All the



UPPER CRETACEOUS
CACHE CREEK SECTION YOLO CO., CALIF
J. M. KIRBY
SEPT., 1941

SCALE IN FEET
0 500 1000 2000 3000 4000 5000

FIG. 3.—Cache Creek section, Yolo County.

formational units previously described are present in this section and their relative thicknesses are here set forth.

<i>Formation</i>	<i>Thickness in Feet</i>
Capay (middle Eocene)	
<i>Unconformity</i>	
Forbes.....	2,606
Guinda.....	2,975
Funks.....	2,589
Sites.....	3,965
Yolo.....	880
Venado.....	1,890
Total thickness—Chico series	14,905
<i>Unconformity (?)</i>	
Shasta series	

This measured section discloses the greatest thickness development of all the formational units of the Chico series except the Yolo and Venado formations. In contrast to the thickening of the upper four formations of the Chico series in a southerly direction, the Venado formation is here observed to be thinner than in any other measured section on the north. This thinning in a southerly direction of the Venado formation apparently continues south of Putah Creek. In the vicinity of Tolenas Soda Springs, Sec. 3, T. 5 N., R. 2 W., the thinning has extended to such a point that the prominent strike-ridge topography, held up by the basal beds of the Venado formation on the north, almost disappears and gives way to low, rounded, grass-covered hills characteristically developed in areas of softer, less resistant, and less massive sediments. Some comment regarding this phenomenon has already been made under the discussion of the Venado formation.

Cache Creek section, Yolo County.—This section was measured along the course of Cache Creek in Secs. 1, 2, and 3, T. 12 N., R. 4 W. The upper beds of the Chico series may be observed along the old road from Rumsey to Arbuckle, a short distance south of the summit, where Pliocene gravels are found resting unconformably on the lower few feet of sandstone of the Guinda formation. The underlying Funks shales occupy the smooth grass- and brush-covered hills between the Arbuckle road and the mouth of Cache Creek Canyon. The remainder of the section is well exposed along the Rumsey to Wilbur Springs highway which follows the course of Cache Creek. The Forbes formation and the greater part of the Guinda formation are not present in this section and the full section of the Chico series in this part of Yolo County must be pieced together from segments exposed on the crest and east flank of Rumsey Hills and in the canyon of Cache Creek west of the Rumsey-Arbuckle road (Fig. 7). Those formations which are exposed in Cache Creek, together with their thicknesses, are here tabulated.

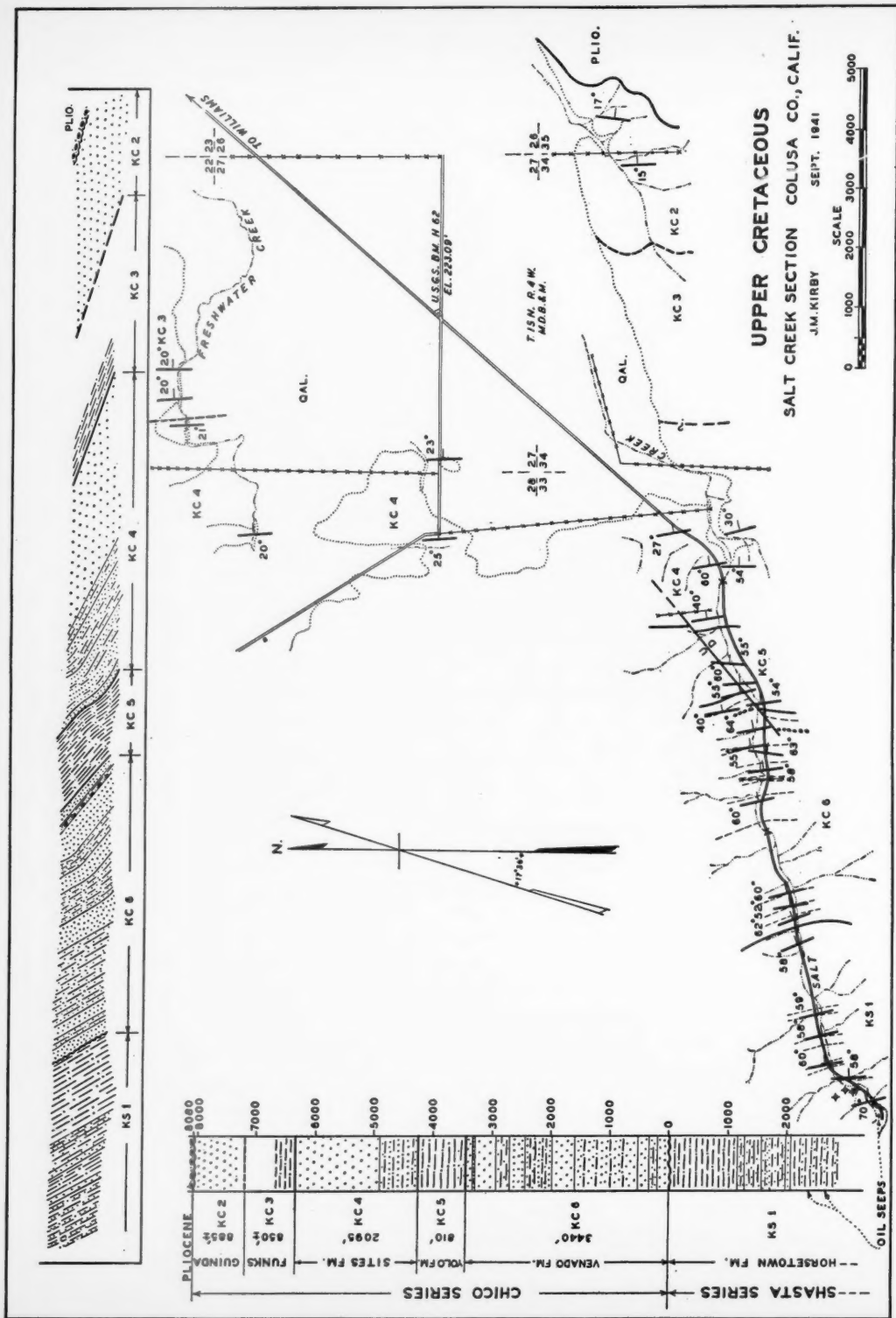


FIG. 4.—Salt Creek section, Colusa County.

<i>Formation</i>	<i>Thickness in Feet</i>
Upper Pliocene gravels	
<i>Unconformity</i>	
Guinda.....	30
Funks.....	1,400
Sites.....	2,515
Yolo.....	1,110
Venado.....	3,495
Total thickness—Chico series	8,550
<i>Disconformity(?)</i>	
Shasta series	

In comparing this section with the Cache Creek section, 27 miles farther southeast, it is worthy of note that the Venado formation particularly, and the Yolo formation to a less extent, have shown an increase in thickness in a northerly direction. In contrast, the Sites, Funks, and Guinda formations are distinctly thinner although maintaining their typical lithologic character and stratigraphic relationships. The absence of the Forbes formation and the thinning of the Guinda formation are entirely the result of the cut-out of beds below the overlapping Pliocene gravels.

Salt Creek section, Colusa County.—This section was examined and measured along Fresh Water and Salt creeks, T. 15 N., R. 4 W. The course of the traverse west of Sec. 34, T. 15 N., R. 4 W., followed the Williams to Clear Lake highway along which are found the best exposures of sediments below the middle of the Sites formation. The upper formations of the Chico series were examined in the low hills north of Fresh Water Creek and south of the mouth of Salt Creek.

This section is incomplete and exposes sediments up to and including the lower part of the Guinda formation. The formations exposed with their thicknesses are here tabulated.

<i>Formation</i>	<i>Thickness in Feet</i>
Upper Pliocene gravels	
<i>Unconformity</i>	
Guinda.....	885±
Funks.....	850±
Sites.....	2,095
Yolo.....	810
Venado.....	3,440
Total thickness—Chico series	8,080
<i>Disconformity?</i>	
Shasta series	

This locality is of particular interest because of the presence of oil seeps and of the so-called "medicinal oil" wells in Sec. 31, T. 15 N., R. 4 W. The oil seeps occur along with springs of brackish or salt water in beds of the Shasta series which lie about 2,500 feet stratigraphically below the base of the Chico series. The oil is found in thin layers of sandstone, bedded with the characteristic dark

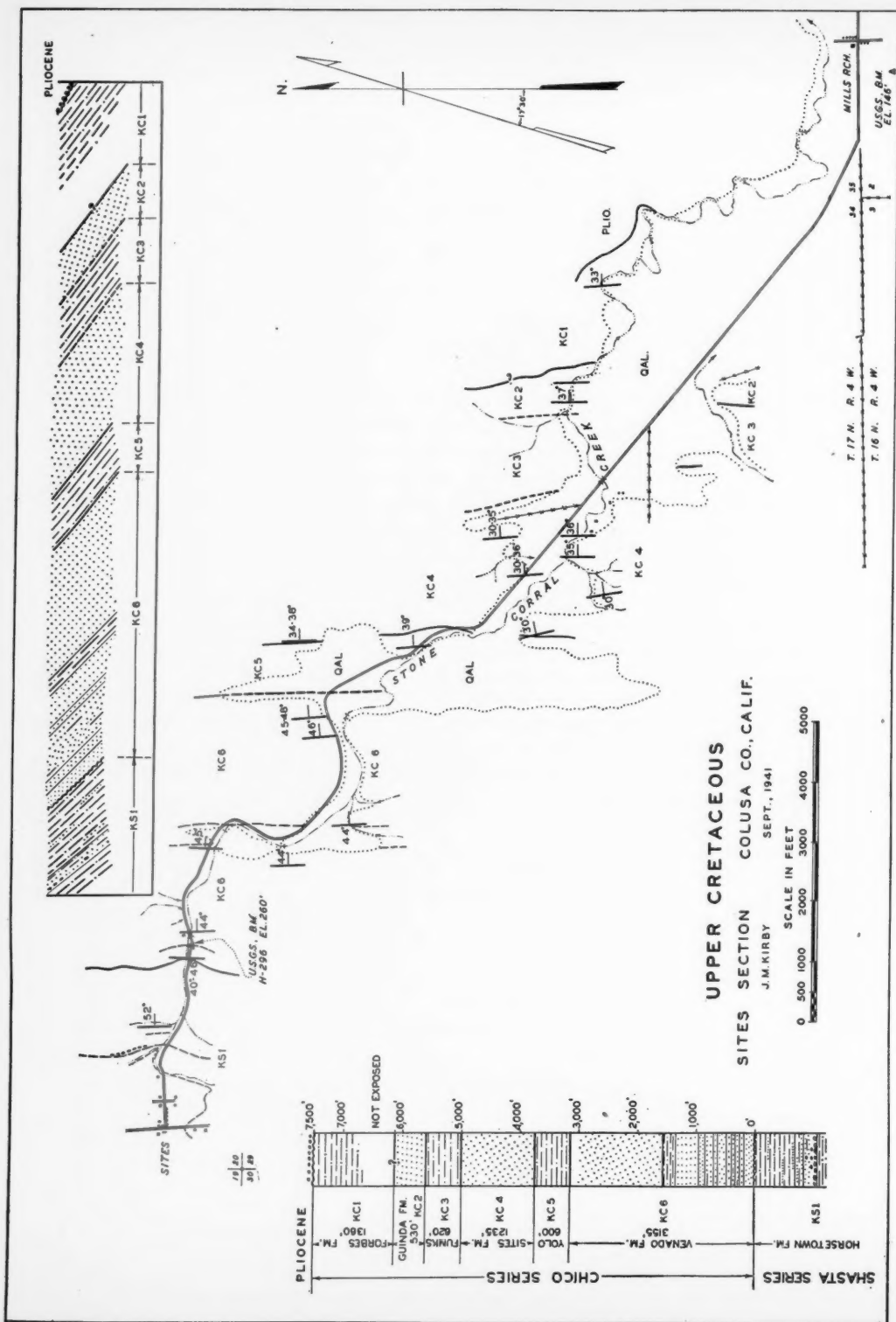


FIG. 5.—Sites section, Colusa County.

gray to greenish gray siltstones of the Shasta series, which dip approximately 70° E.

In this section, the Venado formation maintains a thickness nearly identical with that found at the Cache Creek section 14 miles south. The Yolo, Sites, and Funks formations, however, show continued thinning in a northerly direction.

Sites section, Colusa County.—This section follows the course of the Maxwell to Sites highway up Stone Corral Creek, through the southwestern part of T. 17 N., R. 4 W. A description of several formations of the Chico series here has been given in connection with a discussion of their type localities. All six formational units of the Chico series are represented in this section and their thicknesses are here tabulated.

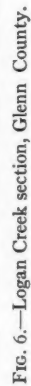
<i>Formation</i>	<i>Thickness in Feet</i>
Upper Pliocene gravels	
<i>Unconformity</i>	
Forbes.....	1,360
Guinda.....	530
Funks.....	620
Sites.....	1,235
Yolo.....	600
Venado.....	3,155
Total thickness—Chico series	7,500
<i>Disconformity (?)</i>	
Shasta series	

In comparing the section exposed along Stone Corral Creek with those described farther south the thinning of all the formations above the Venado is pronounced and reflects their general thinning in a northerly direction. The Venado member, on the other hand, maintains a thickness comparable with that found in the Salt Creek and Cache Creek sections.

Logan Creek section, Glenn County.—The Logan Creek section is the northernmost section examined and measured in connection with this discussion. Geographically, it is a few miles south of the latitude of Willows, Glenn County, and represents approximately the northernmost point at which sections of the Chico series can be observed in any detail. All the formational units heretofore described are present in this section in modified form and are here tabulated.

<i>Formation</i>	<i>Thickness in Feet</i>
Upper Pliocene gravels (?)	
<i>Unconformity</i>	
Forbes.....	946 ±
Guinda.....	1,210 ±
Funks.....	630 ±
Sites.....	125-145
Yolo.....	517
Venado.....	3,242
Total thickness—Chico series	6,670-6,690
<i>Disconformity (?)</i>	
Shasta series	

0	500	1000	2000	3000	4000	5000
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In this section the Forbes formation was not exposed but its presence was assumed from the occurrence of low hills without outcroppings above sandstone beds of the Guinda formation. The uppermost limit of the underlying Guinda formation was likewise not found because of the absence of mappable exposures. It is of interest that here the exposures of the Sites formation are greatly reduced in thickness whereas the overlying Funks formation and the underlying Yolo formation show thicknesses approximately the same as those found in the Sites section 13 miles south. The Venado formation likewise shows a thickness essentially the same as at the south.

CORRELATION

Relationship between measured sections.—Figure 7 shows graphically the correlation of the various formational units between the latitude of Winters, Yolo County, and Willows, Glenn County. The columnar sections shown are taken from Figure 2 to Figure 6, inclusive, the only exception being the Rumsey Hills-Cache Creek section, Yolo County, where a composite section is constructed, by use of the following elements: the surface section on the east flank of Rumsey Hills, T. 12 N., R. 3 W., the section drilled in the Standard Oil Company of California's Tippetts 1-1, Sec. 15, T. 12 N., R. 3 W., and the surface section in Cache Creek, T. 12 N., R. 4 W.

The continuity of the various formations within the area under discussion is subject to little doubt except possibly as to detail, since the interpretations are based largely on actual field mapping of the units in the greater part of the area. Since the sections examined and described show no obvious evidence of unconformities within the Chico series and since the limits of the formations are based on lithologic changes from dominantly sandstone to dominantly shale of varying degrees of sharpness, there may be some discrepancy in the limits set in the various measured sections because of facies changes. These changes should not be great, however, and the limits set should be of practical use and application in future work in the Upper Cretaceous succession of sediments in this general region.

Relationship between west side sections and other sections of Chico series.—The sections available for direct comparison and correlation are limited to those few exposures of Upper Cretaceous sediments on the east side of Sacramento Valley (which by definition have been included in the original "Chico group" of Gabb), the limited areas of Upper Cretaceous sediments around the periphery of Marysville Buttes, Sutter County, and a few well sections between Marysville Buttes and Corning, Tehama County. The evidence of age of the east side exposures is limited to the information to be derived from a study of the molluscan fossils present therein which to date has been insufficient to make a direct tie across the Sacramento Valley. F. M. Anderson, in conversations with the writer, has stated that the type Chico on Chico Creek in Butte County has an age range upward from Coniacian through Santonian into lower Campanian. Anderson stated further that certain ammonoid fossils found in the lower part of the Forbes

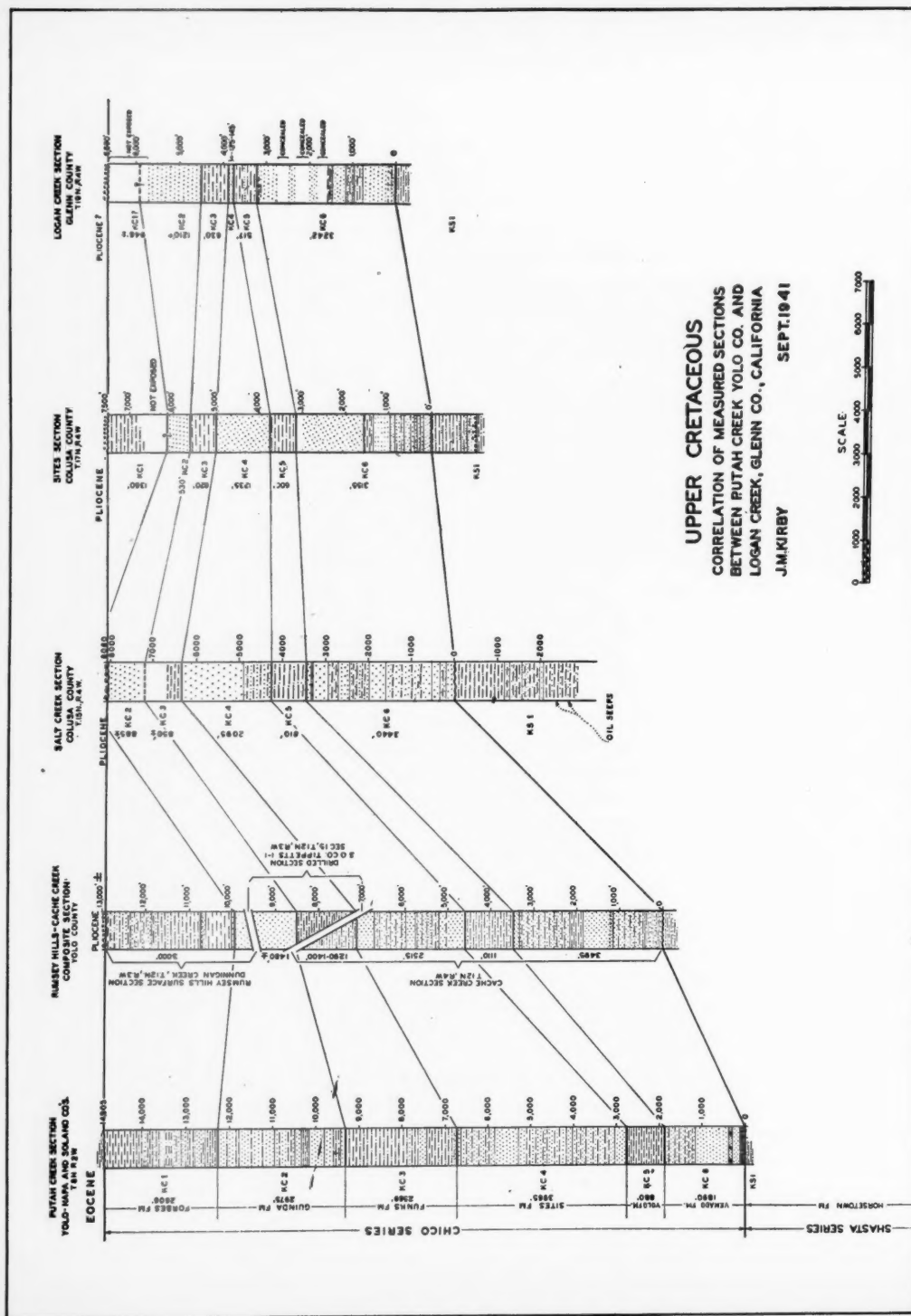


FIG. 7.—Correlation of measured sections between Putah Creek, Yolo County, and Logan Creek, Glenn County, California.

formation on Sand Creek, Colusa County, and from a horizon about 600 feet above the base of the Forbes formation at a point just east of the Nigger Heaven Dome Oil and Gas Company's Lee Bow No. 1, Sec. 22, T. 12 N., R. 3 W., are upper Coniacian in age but possibly somewhat older than the lowest beds exposed at Chico Creek. No comparisons of this section with the Chico Creek section on the basis of foraminiferal faunas are possible since no Foraminifera have been reported from the Chico Creek section as yet.

On the basis of the evidence furnished by the molluscan faunas, a general statement may be made to the effect that the basal beds of the type "Chico group" on Chico Creek are probably no older than basal Forbes, as exposed on the west side of Sacramento Valley. This conclusion furnishes an index to the amount of eastward transgression of the Upper Cretaceous sediments upon the Sierra Nevada block, since the west side sections show 6,000 to 12,000 feet of beds of Upper Cretaceous age below the base of the Forbes formation which are not represented on the east side.

A comparison of the west side sections with the exposures at Marysville Buttes and the oldest beds of the Chico series penetrated in deep wells of the Buttes Oilfields, Inc., furnishes more concrete evidence on which correlation may be based. The youngest Upper Cretaceous beds exposed on the south slope of Marysville Buttes consist of sandstones and interbedded silty shales containing fossils which have been collected and cataloged by several investigators. Residual limestone concretions at or immediately below the contact of the Upper Cretaceous with the overlying Capay beds (middle Eocene) contain fossils among which are *Baculites* sp., *Parapachydiscus* sp. and a small form of *Inoceramus*. Allan Bennison¹² lists the following forms from two fossiliferous horizons below the base of the Capay formation.

Cymbophora ashburneri Gabb
Tellina mathewsoni Gabb
Tellina nanaimoensis Gabb
Meretrix lens Gabb
Lucina dubia Gabb
Acila truncata Gabb
Dentalium stramineum Gabb
Trigonia evansana (Meek)

Gyrodes expansa Gabb
Meretrix varians Gabb
Spisula ashburneri (Gabb)
Oligoptycha obliqua (Gabb)
Turritella chicoensis Trask
Glycymeris veatchi Gabb
Pharella cf. alta Gabb

This list contains material collected and identified by Bennison, Charles Merriam, and Howell Williams. Fossil lists in the files of the Standard Oil Company of California also show the presence at Marysville Buttes of *Spisula cf. chicoensis* and *Baculites chicoensis*. The form, *Oligoptycha obliqua* (Gabb), has been listed by Taff, Hanna and Cross¹³ as very common in collections from Chico Creek and is widely reported from other localities. They state further that this species is believed to be confined to that part of the Upper Cretaceous which includes the Chico series as exposed on Chico Creek, Butte County.

¹² Private report for Buttes Oilfields, Inc. Permission for use of material granted by O. G. Green and Harry R. Johnson.

¹³ J. A. Taff, G. D. Hanna, and C. M. Cross, *op. cit.*, p. 1323.

The upper sandy beds of the Chico series as exposed at Marysville Buttes contain the relatively thin, white, clay-filled, quartz-sand member for which the name "Kione sand" has been proposed by Harry R. Johnson.¹⁴ Johnson presents the following exposed section of Upper Cretaceous rocks (with slight modifications) in the east half of Sec. 35, T. 16 N., R. 1 E., M.D.B.&M.

Capay formation (middle Eocene)

	Unconformity	Feet
Chico series		
Gray, silty shales with thin, greenish glauconitic sands		200
Greenish gray, fossiliferous, glauconitic sandstone with limy layers		40
Gray siltstone and fine sandstone which are coarser and more gritty at the base		60
Two or more hard, dark gray, limy sandstone beds; black weathering		10
Soft, white, micaceous, clay-filled sand ("Kione sand") which produces inconspicuous outcrops except on steep slopes. Erosion tends to develop swales, saddles, and local slumped areas		50-100
Fairly resistant, buff sandstone, carrying hard, limy ledges and reddish brown, nodular concretions a few inches to several feet in diameter. Also, interbedded, dull gray and dull tan sandy shales or mudstones with occasional harder ledges		1,200±
Platy, brown, calcareous sandstone		75
Sandy limestones with cone-in-cone structure and mud cracks		20
Micaceous sandstone with grayish to brown, flaggy layers toward base		60
Limonic, rather soft, featureless shale, with some limy layers and cone-in-cone structure in mudstone layers; soft shale weathering light buff at base		180
Soft sandstone and shale, with two or three prominently exposed, hard, dark brown, calcareous ledges, each several feet thick, toward base		400
Grayish to brown, locally nodular sandstone, with some thin shaly layers		50-75
Hard, prominently though locally exposed, gritty sandstone and fossiliferous conglomerate, composed of closely crowded angular to subangular, metamorphic and limonitic pebbles, with occasional white, quartzose fragments in a grayish green, sandy matrix. Where well exposed, this member exhibits a strong, rusty to brownish red surface		5-30
Sandy beds, becoming shaly		300+
Total exposed thickness—Chico series		2,650-2,750±

Intrusive contact with andesite porphyry core

Wells drilled south of the outcrop section of the Chico series at Marysville Buttes, previously described, show a downward continuation of the lowest exposed shales, with thin sandstone members here and there which contain commercial quantities of natural gas. Shale cores from these wells show the presence of the *Marginulina jonesi* fauna, common in the Forbes formation on the west side of Sacramento Valley, which occurrence provides a fairly reliable correlation of at least this part of the section with the Forbes formation. It is thought that the uppermost sandy part of the Chico series here may not be represented on the outcrops to the west and that they may represent the youngest Upper Cretaceous sediments present in this part of California. A separate formation designation may be in order for this part of the section.

On the basis of Schlumberger electric logs and core samples containing the *Marginulina jonesi* fauna, correlations may be tentatively extended farther to the Amerada Petroleum Corporation's C.L.I. No. 1, Sec. 34, T. 16 N., R. 1 W., The Ohio Oil Company's Willard No. 1-A, Sec. 18, T. 20 N., R. 2 W., and the North-ern Counties Petroleum Corporation's Ewers-Mooney No. 1, Sec. 25, T. 24 N.,

¹⁴ Private report for Buttes Oilfields, Inc.

R. 3 W., and it may be concluded that the upper unnamed sandy unit and the underlying Forbes formation are present in these three wells. It is notable that none of these wells found any prominent sandstone member below the *Marginulina jonesi* zone which can be directly correlated with the Guinda formation of the west side sections, although the Buttes Oilfields, Inc., Buttes No. 6, Sec. 1, T. 15 N., R. 1 E., in the interval between 7,073 and 7,402 feet, showed a foraminiferal assemblage which may be representative of the Funks formation. The conglomerate zone in this well between the depths of 7,402 and 7,650 feet, total depth, which underlies the foraminiferal assemblage tentatively assigned to the Funks formation, may represent the equivalent of the Sites formation of the west side sections, although no definite evidence of age other than stratigraphic position is available. The depth to the basement complex in this well is not known but should occur not far below the completed depth. The implied range of the sediments here, coupled with that at Chico Creek, furnishes a means of estimating the degree of transgression and overlap of beds between the exposed west side sections and the sections exposed on the east side of Sacramento Valley.

Evidence for correlation of the west side sections with exposures in the north Mt. Diablo area is very meager but such evidence as is available points to the fact that the highest beds of the Chico series in the north Mt. Diablo area are perhaps somewhat younger than the highest beds exposed in the Putah Creek section and are probably lowest Moreno or uppermost Panoche in age. Deep well cores at McDonald Island gas field, Sec. 25, T. 2 N., R. 4 E., show the presence of Upper Cretaceous sediments as young as Moreno and Garzas, but the penetration here was insufficient to reach the *Marginulina jonesi* zone representing the Forbes formation. The same may be said of the Amerada Petroleum Corporation's F.D.L. No. 1, Sec. 15, T. 2 S., R. 5 E., Tracy gas field. In the latter case, however, the youngest Upper Cretaceous beds present are apparently of lower Moreno age.

On the basis of evidence presented in the preceding paragraphs, it may be stated with considerable assurance that the Chico series as exposed on the west side of the Sacramento Valley and in deep well sections north of the junction of the San Joaquin and Sacramento rivers, probably includes no sediments as young as Moreno and would therefore be limited to the Panoche and Pioneer groups of F. M. Anderson. Evidence confirming the presence of the pioneer group is furnished by the reported occurrence¹⁵ of fossil mollusks of upper Albian age in the lowest beds of the Venado formation west of Willows, Glenn County. No basis has yet been established for the separation of the west side sections into the two groups, however.

SUMMARY AND CONCLUSIONS

The Chico series of sediments on the west side of the Sacramento Valley dis-
closes a succession of dominant sandstone, shale, or siltstone members which can

¹⁵ Frank M. Anderson, oral communication.

be widely recognized and mapped along the valley margin. The recognition from place to place of these cartographic units furnishes a basis for a subdivision of the thick Upper Cretaceous sequence into six or more members to which formational significance can be attached. The lithologic character of each formation, coupled with diagnostic microfaunal assemblages in certain of the shaly units, furnishes a means of correlating well and surface sections over rather long distances.

Six of the formations into which the Chico series can be logically subdivided in this region are present nearly continuously along the west side of the Sacramento Valley between Winters, Yolo County, and Willows, Glenn County. A seventh is suggested from the presence in certain well sections and at Marysville Buttes of sandy, post-Forbes sediments, which may not be present on the outcrop along the west side of the valley, unless possibly represented by the highest exposed beds in Dunnigan Creek, Sec. 36, T. 12 N., R. 3 W., and in this report included with the Forbes formation.

It is of possible significance that W. P. Popenoe¹⁶ recognizes six well marked lithologic members, alternately predominantly sandstones and shales, in the northern and northeastern margin of the Sacramento Valley. He calls attention to the probability that the upper sandstones of Oak Run Valley, 2,500 to 3,000 feet above the base of the section, are the correlatives of the base of the Cretaceous section at Chico Creek, Butte County (type locality of Gabb's "Chico group"). On further study of the Chico series in this general region, it may be found that Popenoe's divisions have their equivalents in the several lithologic units described in this discussion. Evidence of transgressive overlap of Chico series sediments onto older rocks in the area north and northeast of Red Bluff suggests the probability that certain members present in the thicker sections at the south are eliminated in this direction.

Attention has already been called to the thinning or disappearance of certain sandstone members in a northerly direction along the west side outcrops, as well as in an easterly direction beneath the Sacramento Valley floor. The disappearance or thinning of sandstone units in these directions suggests a southwesterly source for the material deposited therein. The material comprising the exposures at Chico Creek and other localities along the eastern margin of the valley, recognized as occupying a stratigraphic position relatively high in the Panoche group of the Chico series, may well have had a source in the Sierra Nevada province.

*A dual source of coarse, clastic material for the Sites and Venado formations is suggested by Figure 8. In this drawing, a position relatively close to an easterly shoreline is postulated for the west side outcrops of these formations, particularly those at or near Cache Creek and Rumsey Hills. Surface evidence on which to base a westerly extension of this diagram is not available at the latitude of Cache Creek. Consequently, evidence to show that some part of the material comprising the Venado or Sites formations had a source on the west, as well as on the east,

¹⁶ W. P. Popenoe, "Cretaceous: East Side Sacramento Valley, Shasta and Butte Counties, California," *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 27, No. 3 (March, 1943), pp. 306-12.

must be drawn indirectly. In support of the suggestion of a dual source, attention is called to the exposures on the flanks of the Fruto syncline, in Ts. 19 and 20 N., R. 5 W., Glenn County. This area is somewhat north and west of the general area under discussion but has a direct bearing on the question raised. On the west flank of the syncline, south of the Elk Creek-Willows road, the basal part of the Chico series is characterized by thick, well developed conglomerate beds which are in contrast to the lithologic character of the basal Venado formation along the western margin of the Sacramento Valley (east flank of Sites anticline at this latitude). The increase in the proportion of conglomerate contained in these western exposures is doubtless a function of proximity to a western source of detritus, that is, to the western border of the Upper Cretaceous basin of deposition.

The apparent maximum age range of the Chico series of sediments in the Sacramento Valley, based on available evidence in the possession of the writer, appears to be from upper Albian to lower Campanian. The lower limit is represented by basal beds of the Venado formation; the upper limit by the upper beds on Chico Creek, and possibly at Marysville Buttes. From these facts we may conclude that both the Pioneer and Panoche groups of F. M. Anderson, or the Pacheco and lower Asuncion groups of N. L. Taliaferro, are represented. Evidence sufficient to define the extent to which these groups are present, or to separate them in the field is still lacking. It is likewise fairly certain that the Moreno group of Anderson and the uppermost Asuncion group of Taliaferro are nowhere represented on the outcrop in the Sacramento Valley. Neither do deep wells drilled to date on the floor of the valley north of the junction of San Joaquin and Sacramento rivers definitely disclose the presence of beds belonging to the Moreno or upper Asuncion groups. Deep-well control north of the McDonald Island gas field, San Joaquin County, is very meager, however, and it may be found ultimately that these uppermost Chico series sediments extend northward in the deeper parts of the trough as far as the Rio Vista gas field.

The evidence of the mid-Cretaceous disturbance and of the Santa Lucian orogeny, postulated by N. L. Taliaferro¹⁷ as separating the Chico and Shasta series and as the basis for his Pacheco and Asuncion groups, respectively, in the Santa Lucia Range and elsewhere in the Central Coast Ranges, is very meager in the area. Attention has been called in a previous paragraph to thick conglomerates at the base of the Chico series on the west flank of the Fruto syncline, Ts. 19 and 20 N., R. 5 W. Further, more detailed studies of this area may disclose the fact that the influx of conglomerates in this direction may be accompanied by truncation and overlap of beds below and above an angular unconformity separating the Shasta and Chico series, and reflects sedimentation on the western margin of the basin of deposition, adjacent to a western landmass. Along the western margin of the Sacramento Valley, however, the Shasta-Chico contact is not universally marked by basal conglomerates in the Chico series,

¹⁷ N. L. Taliaferro, *op. cit.*, pp. 129 and 131.

although in some localities gritty sandstones or relatively thin pebble or cobble conglomerates are present at various levels in the lower few hundred feet of the Venado sandstone member. Elsewhere, thinly bedded or rhythmically banded sandstones of the Venado rest without obvious discordance or irregularity on the siltstones of the Shasta series and the break represented seems primarily one of facies and not essentially different from the break in facies separating other sandstone and siltstone units higher in the Chico series. The conglomerates certainly indicate changes in conditions of source and deposition, but it is believed that the disturbance indicated was a considerable distance west of the area and that the effects were not strongly felt this far east.

Evidence of disturbances within the Chico series itself, aside from the occurrence of alternating fine and coarse sediments, is confined to the presence of thin lenticular bodies of pebble or cobble conglomerate at various horizons in the lower part of the Forbes formation and in the upper part of the Sites formation. These conglomerates ordinarily contain water-worn fragments of sedimentary rocks of a type which probably originated in some earlier part of the Cretaceous. Here also, the evidence does not point to any major diastrophic effects locally, and the area of disturbance in which elevation and erosion took place probably lay an unknown distance west.

CRETACEOUS: EAST SIDE SACRAMENTO VALLEY,
SHASTA AND BUTTE COUNTIES, CALIFORNIA¹

W. P. POPENOE²
Pasadena, California

ABSTRACT

Isolated outcrops of Upper Cretaceous beds are found in the lower stream valleys, north, northeast, and east of Redding, Shasta County. The total thickness of the exposed beds aggregates 4,000 feet or more. Six well marked lithologic members, alternately predominantly sandstones and shales, may be recognized. The upper sandstones of Oak Run Valley, 2,500-3,000 feet above the base of the section, are the probable correlatives of the base of the Cretaceous section at Chico Creek 70 miles south.

INTRODUCTION

This article presents a summary of the stratigraphy of the Upper Cretaceous beds cropping out north and east of the city of Redding, Shasta County, California, and suggests the probable age relations of these deposits to the Cretaceous deposits of Chico and Butte creeks on the east side of the Sacramento Valley near the city of Chico, in Butte County. This article represents a progress report, as the study of these Cretaceous beds is not yet complete. The investigation as a whole is the second of a series of projected studies of the faunas and stratigraphy of selected Upper Cretaceous sections of the Pacific Coast area. The results of the first study of this series dealing with the Cretaceous of southern California have recently been summarized in three articles.³

Investigation of the Cretaceous of the Redding region was begun in 1936 with support of a grant from the Penrose Bequest of the Geological Society of America, and since then has been pushed forward from time to time as other duties permitted. The detailed paleontology and stratigraphy of the Cretaceous of this region will be described in a report submitted to the Society when the work is completed.

LOCATION

Considerable areas of Cretaceous rocks are found cropping out in a fan-like series of isolated exposures lying north, northeast, and east of the city of Redding at the north end of the Sacramento Valley. The area is included in the Redding

¹ Read before the Pacific Section of the Association at Los Angeles, October 16, 1941. Manuscript received, June 18, 1942.

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The writer here acknowledges his appreciation for the help given in this work by the Geological Society of America. Further, he thanks the Society for permission to present this preliminary stratigraphic report through the medium of the *Bulletin* of the American Association of Petroleum Geologists.

³ W. P. Popenoe, "Upper Cretaceous Mollusca from Southern California," *Jour. Paleon.*, Vol. 11, No. 5 (July, 1937).

—, "The Trabuco and Baker Conglomerates of the Santa Ana Mountains," *Jour. Geol.*, Vol. 49, No. 7 (October-November, 1941).

—, "Upper Cretaceous Formations and Faunas of Southern California," *Bull. Amer. Assoc. Petrol. Geol.*, Vol. 25, No. 2 (February, 1942).

Quadrangle of the United States Geological Survey topographic atlas, and the areas of exposure of the Cretaceous rocks are indicated on the geologic map of the Redding Folio (*U. S. Geol. Survey Folio 138*). The youngest surface rocks in the region are Tertiary land-laid sediments, and associated lavas, tuffs, ash beds, and other pyroclastics. The Cretaceous is exposed along the bottoms and lower slopes of the valleys of streams which have cut through the Tertiary cover into the older rocks below. The Cretaceous exposures are hence separated from one another by strips of Tertiary rocks that cap the interstream divides. The largest areas of outcrop, from north to south, are found in the valleys of Sand Creek, Little Cow Creek and its tributaries, Swede Creek, Oak Run, Clover Creek, Old Cow Creek, and South Cow Creek. The location of these exposures, their areal extent, their relationship to one another and to Redding and the distribution of the mappable members are indicated in Figure 1.

STRUCTURE

North of Clover Creek, the Cretaceous beds dip gently south or southeast at angles ordinarily of less than 10° , and in some places less than 5° . In upper Clover Creek, the dips are variable, and in places the strata are essentially flat. South of Clover Creek, the prevailing dips are westerly. In general, the Cretaceous beds appear to be warped into a broad, open, shallow syncline with northeast-trending axis approximately coinciding in position with upper Clover Creek valley. Considerable small-scale faulting is evident in places in the southern limb of the syncline.

STRATIGRAPHY OF REDDING DISTRICT

The Cretaceous rocks of the Redding district have a total thickness of at least 4,000 feet, and may be divided on a lithologic basis into six members. With one exception, the contacts between the members appear to be gradational and conformable. The lithologic units, in ascending order, are here described.

MEMBER I

The basal member of the Redding Cretaceous section consists of about 700 feet of sandstone, with a basal conglomerate, not everywhere present, varying from 10 to 40 feet in thickness. The base of the member is well exposed along the northern border of the Sand Flat and Little Cow Creek areas. The main areas of outcrop are found at Sand Flat and north of the Alturas-Redding highway (*U. S. 299*) in the Bellavista district. In the former region, the Cretaceous, nearly flat, rests on a basement of Devonian sediments and associated late Paleozoic igneous rocks. In the latter region, the Cretaceous beds rest with a profound angular unconformity on the Triassic Pit shale. The Cretaceous basal conglomerate is composed of well rounded and well cemented pebbles and cobbles including quartzites, cherts, shales, sandstones, and a considerable variety of both intrusive and effusive igneous rocks. The sandstones succeeding the basal conglomerates above are rather soft, coarse, brown and dominantly massive. In some

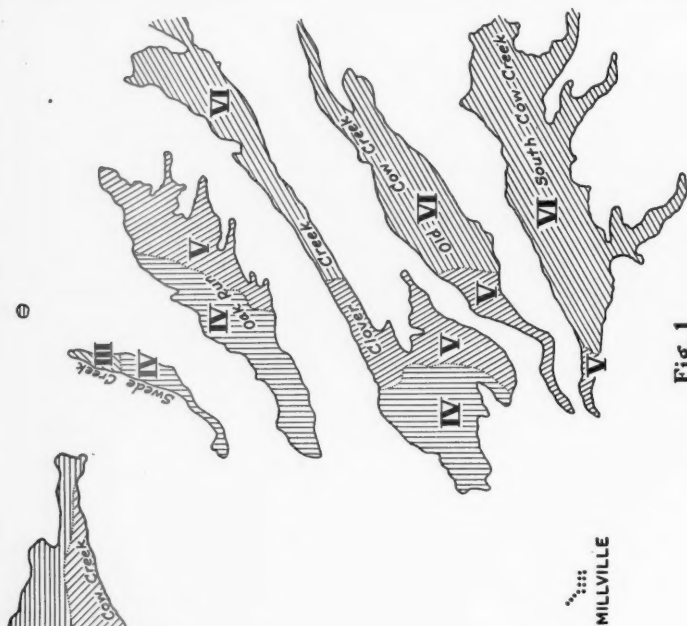
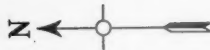


Fig. 1
**SKETCH MAP
 OF A PART OF THE
 REDDING QUADRANGLE
 SHOWING THE PRINCIPAL
 CRETACEOUS EXPOSURES**

STRATIGRAPHY BY W. P. POPENOE



BELLAVISTA

LEGEND

Member VI. Dark-gray sandy shales with numerous thin-bedded sandstone layers. Conformable on the member below. Thickness: 400 feet plus.

Member V. Coarse, arkosic gray sandstone alternating with finer-grained sandstone layers. Numerous thick beds of coarse conglomerate developed in the lower half of the member. Thickness: about 900 feet. Unconformable? on member below.

Member IV. Dark-gray sandy shales and shelly sandstones, with a few thin, coarse sandstone beds. Thickness: 1000 feet plus. Conformable on member below.

Member III. Coarse, cross-bedded gray sandstone, with a few thin, interbedded shale beds. Thickness: 250 feet plus. Conformable on member below.

Member II. Soft gray, sandy clay shale with numerous concretions and a few thin sandstone beds. Thickness: about 800 feet. Conformable on member below.

Member I. Coarse, brown arkosic cavernous weathering, cross-bedded sandstone below grading to finer-grained and better bedded rock above. Discontinuous conglomerate 10-40 feet thick. The sandstone is about 750 feet. Unconformably overlies Triassic and Paleozoic sediments and igneous rocks.

SCALE:



REDDING

places they tend to show pronounced cross-bedding and cavernous weathering. Toward the top of the member, the sandstones become progressively thinner and more shaly, and pass gradationally into the member overlying. The strike of the beds approximates N. 70° E. in most of the exposure, with dips of 5°-10° SE. The member is fossiliferous throughout, and has yielded a large fauna.

MEMBER II

The second member consists of 800 feet of silty to sandy dark gray shales with interbedded sandstones and some ironstone concretionary beds. Some fairly good exposures of this member are found in road cuts along the Redding-Alturas highway (U. S. 299), from 1 to 4 miles northeast of Bellavista. Bedding is indistinct and satisfactory determination of attitude is hard to get. The strike of the beds is about the same as that of the member underlying, and the dip ranges from 8° to 12° SE. The shales in many places are nearly barren, but in a number of localities they have yielded good faunas.

MEMBER III

The shales of Member II are overlain conformably by a series of greatly cross-bedded, clean, hard, gray, arkosic sandstones that crop out along the course of Little Cow Creek in the region one mile northeast of Bellavista. These resemble the sandstones of Member I, but are finer-grained, somewhat harder, and gray rather than brown. This member is about 200 feet thick on Little Cow Creek. A similar sandstone containing a similar fauna crops out about 5 miles northeast in the upper valley of Swede Creek, and is believed to represent a continuation of the same member. The Swede Creek beds are likewise about 200 feet thick. The sandstones in both localities have yielded a fairly diversified and well preserved fauna.

MEMBER IV

The sandstones of Swede Creek grade upward into a series of dark sandy shales, and soft shaly sandstones interbedded with thin sandstone layers. These beds crop out downstream in Swede Creek for a distance of a mile or more. Similar beds crop out on the slopes of the north side of Oak Run valley. They have been included here with the Swede Creek shales of Member IV. The strike of these shales nearly coincides with the trend of the lava-covered Swede Creek-Oak Run divide, and an unknown thickness of the section is hence hidden here. If the beds hidden beneath the lava have the same strike and dip as the exposed beds on either side, they may represent a lost interval in the section of about 1,000 feet. The exposed shale beds in Swede Creek and Oak Run valleys aggregate about an additional 1,000 feet in thickness. The shales may be traced southwest across Clover Creek valley into Basin Hollow where they disappear beneath the stream gravels of the Millville plain. Member IV is sparingly fossiliferous, but has yielded a few good collections of fossils both on the Swede Creek and Oak Run sides. The faunas show a profound change from those of the Little Cow

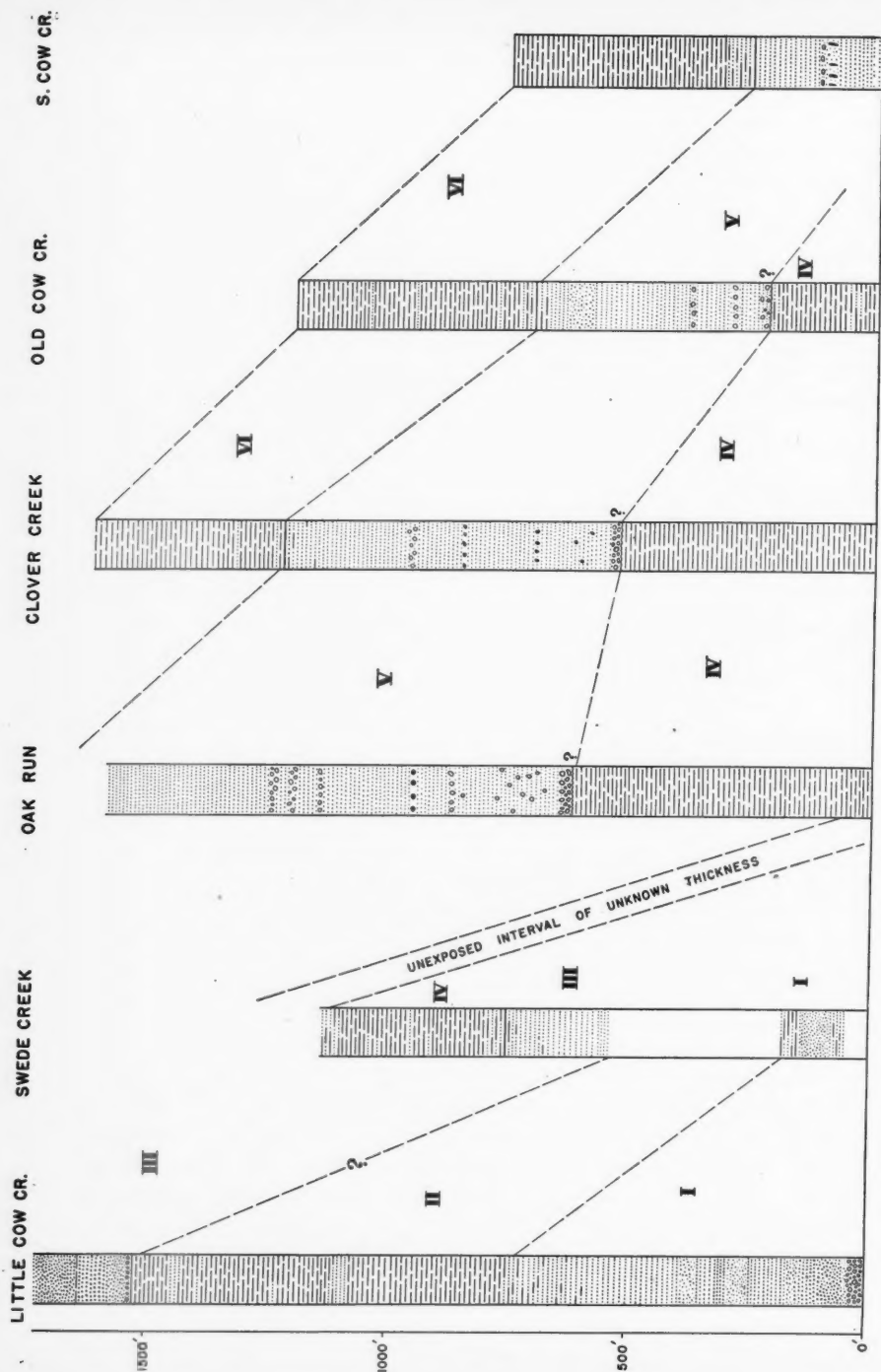


Fig. 2

GENERALIZED COLUMNAR SECTIONS ~ CRETACEOUS OF THE REDDING QUADRANGLE
SHOWING LOCAL DEVELOPMENT OF THE STRATIGRAPHIC MEMBERS

Creek and upper Swede Creek localities, and introduce many species found abundantly in nearly all Cretaceous exposures south of Oak Run as far as Chico Creek and Pentz in Butte County.

MEMBER V

The shales of Member IV are succeeded above abruptly by a conglomerate and sandstone series at least 900 feet thick. The contact between the members is not well exposed but probably represents an unconformity. Besides the sharp lithologic break there is an apparent change of strike across the contact of 20° – 40° . The sandstones of Member V are ordinarily coarse, arkosic, light gray, well cemented, and thick-bedded. The lower levels of the member likewise contain a number of widely spaced conglomerate beds 10–20 feet thick, and composed of smoothly rounded pebbles and cobbles of varied composition. Conglomerates are rare or absent in the upper part of the member, in which the sandstones are coarse, nearly massive, and in places greatly cross-bedded. The best exposures of this member are on the south side of Oak Run valley, where the lower conglomerates and sandstones determine a line of prominent hills. The member may be traced southwest from Oak Run valley across Clover Creek valley and Old Cow Creek to South Cow Creek. In the more northerly exposures, the beds of the member strike about N. 20° E., and dip 5° – 10° SE. Farther south, the dips flatten. Coarse sandstones lithologically and faunally very similar to those of Oak Run crop out in the Burney Quadrangle on the east, in the upper valleys of Old Cow, South Cow, and Bear creeks, and dip west beneath the shales of the uppermost Member VI. These apparently represent the reappearance of Member V on the east limb of the syncline. They may be traced up Bear Creek valley to within 20 miles of Lassen National Park. In nearly every area examined, the rocks of this member have yielded excellent collections of fossils.

MEMBER VI

Member VI consists of dark shale which crops out extensively in upper Clover Creek, Old Cow Creek, and South Cow Creek valleys. The shales are similar in appearance and lithology to those of members II and IV, except that they are somewhat better layered, and contain more sandstone. They show low and irregular dips in most places with considerable evidence of local distortion and small-scale faulting. The member is probably 500 feet thick in the Old Cow Creek region, and may be considerably more. The contact with the underlying sandstones of Member V is not well exposed in most places, but in upper Old Cow Creek valley appears to be gradational with an alternation of fairly thick sandstone and shale beds throughout several hundred feet of section. The member has yielded a fairly good fauna mostly from localities in upper Clover Creek.

The columnar sections illustrating the described relationships of these members, and their developments in different areas, are shown in Figure 2. The thicknesses assigned to the members in the three right-hand columns are estimates and are probably not precise.

PROBABLE AGE EQUIVALENTS OF MEMBERS

While some work has been done in determining the composition and the succession of the faunas in this and other California Cretaceous areas, any correlation attempted here must be provisional and tentative. The faunas of the Redding region can be grouped into two large sub-faunas. The older sub-fauna ranges from the base of the Cretaceous section to the basal beds of Member IV. Some of the most abundant and characteristic forms of this sub-fauna include *Glycymeris pacificus* Anderson, *Gyrodes dowelli* White, *Pugnellus manubriatus* Gabb, several species of small *Scaphites*, and a variety of keeled, *Schloenbachia*-like ammonites. The sub-fauna may number 150 species, most of which are new. Nothing resembling this assemblage has been found on the east side of the Sacramento Valley south of Swede Creek; but it is present in the lower part of the Cretaceous section near Yreka in Siskiyou County, and in southern Oregon; near the base of the Cretaceous sections on Roaring River near Red Bluff, and along Putah Creek near Winters; in the Dark Hole Quadrangle southwest of Coalinga; and it is splendidly developed in the earlier Cretaceous beds of the Santa Ana Mountains in Orange County, southern California.

The upper sub-fauna at Redding appears in the shales of Member IV a few hundred feet above the base and ranges to the top of the section of this region. A few of the most abundant and characteristic forms of this assemblage include *Glycymeris veatchii* Gabb, *Gyrodes expansa* Gabb, *Plectocion curvirostris* (Gabb), and *Cucullaea truncata?* Gabb. Ammonites are rare with the exception of a species of *Baculites* which occurs in some localities in great numbers. The upper faunal assemblage may total 200 species. This faunal assemblage occurs likewise at Butte and Chico creeks in Butte County, in the lower 200 feet of the Cretaceous section. The rather sparse collections obtained from horizons 200-1,000 feet above the base of the section at Chico Creek can not at present be definitely correlated with any part of the Redding section but may represent some part of Member VI. The faunas from horizons 1,000-2,000 feet above the base of the section at Chico Creek are characterized by the appearance of many species not found at Redding. For this reason, the upper 1,000 feet, and perhaps the upper 1,800 feet of the Chico Creek section, are believed to be younger than any of the beds exposed in the Redding region.

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PAST AND PRESENT OFFICERS OF THE ASSOCIATION

<i>Elected In</i>	<i>At</i>	<i>President</i>	<i>Vice-President¹</i>	<i>Secretary- Treasurer²</i>	<i>Editor³</i>
1917	Tulsa	J. Elmer Thomas	Alex Deussen	M. G. Mehl	C. H. Taylor
1918	Oklahoma City	Alex. Deussen	I. C. White ⁴	W. E. Wrather	C. H. Taylor
1919	Dallas	I. C. White ⁴	Irving Perrine	C. E. Decker	C. H. Taylor
1920	Dallas	W. E. Pratt	Alex. W. McCoy	C. E. Decker	R. C. Moore
1921	Tulsa	G. C. Matson ⁵	G. C. Gester	C. E. Decker	R. C. Moore
1922	Oklahoma City	W. E. Wrather	Max W. Ball	C. E. Decker	R. C. Moore
1923	Shreveport	Max W. Ball	F. W. DeWolf	C. E. Decker	R. C. Moore
1924	Houston	J. H. Gardner	E. G. Gaylord	C. E. Decker	R. C. Moore
1925	Wichita	E. L. DeGolyer	R. S. McFarland	C. E. Decker	R. C. Moore
1926	Dallas	Alex. W. McCoy	C. R. McCollom	Fritz L. Aurin	J. L. Rich
1927	Tulsa	G. C. Gester	Luther H. White	David Donoghue	J. L. Rich
1928	San Francisco	R. S. McFarland	J. E. Elliott	David Donoghue	J. L. Rich
1929	Fort Worth	J. Y. Snyder ⁶	Fred H. Kay	A. R. Denison	F. H. Lahee
1930	New Orleans	Sidney Powers ⁷	Ralph D. Reed ⁸	Marvin Lee	F. H. Lahee
1931	San Antonio	L. P. Garrett	L. C. Decius	Frank R. Clark	F. H. Lahee
1932	Oklahoma City	F. H. Lahee	R. J. Riggs	W. B. Heroy	R. D. Reed ⁹
1933	Houston	Frank R. Clark	George Sawtelle	W. B. Heroy	L. C. Snider
1934	Dallas	W. B. Heroy	E. B. Hopkins ¹⁰	M. G. Cheney	L. C. Snider
1935	Wichita	A. I. Levorsen	F. A. Morgan	E. C. Moncrief	L. C. Snider
1936	Tulsa	Ralph D. Reed ⁸	C. E. Dobbin	Chas. H. Row	L. C. Snider
1937	Los Angeles	H. B. Fuqua	C. L. Moody	Ira H. Cram	W. A. Ver Wiebe
1938	New Orleans	D. C. Barton ⁹	H. W. Hoots	Ira H. Cram	W. A. Ver Wiebe
1939	Oklahoma City	Henry A. Ley	L. M. Neumann	Ed. W. Owen	W. A. Ver Wiebe
1940	Chicago	L. C. Snider	John M. Vetter	Ed. W. Owen	W. A. Ver Wiebe
1941	Houston	Ed. W. Owen	Earl B. Noble	E. O. Markham	W. A. Ver Wiebe
1942	Denver	F. L. Aurin	Paul Weaver	E. O. Markham	W. A. Ver Wiebe

¹ From March, 1920, to March, 1932, the corresponding office was *first vice-president*² From March, 1929, to March, 1932, the corresponding office was *second vice-president in charge of finances*.³ From March, 1929, to March, 1932, the corresponding office was *third vice-president in charge of editorial work*.⁴ Died, November 25, 1927.⁵ Died, January 3, 1940.⁶ Died January 10, 1930.⁷ Died, November 5, 1932.⁸ Died, January 20, 1940.⁹ Died, July 8, 1939.¹⁰ Died, July 5, 1940.

JOINT ANNUAL MEETING, FORT WORTH, APRIL 7-9, 1943

AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS
SOCIETY OF ECONOMIC PALEONTOLOGISTS AND MINERALOGISTS
SOCIETY OF EXPLORATION GEOPHYSICISTSF. L. AURIN¹
Fort Worth, Texas.

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Vice-President, Paul Weaver, Houston, Texas
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FORT WORTH ANNUAL MEETING CHAIRMEN

General	Karl A. Mygdal, Pure Oil Company, Box 2107
Technical program	A. I. Levorsen, 221 Woodward Boulevard, Tulsa, Okla.
Technical arrangements	Thomas B. Romine, Sinclair Prairie Oil Co., Box 1990
Hotels	Ralph H. Cummins, Cummins and Berger, 1601-03 Trinity Bldg.
Finance	Richard H. Schweers, The Texas Company, Box 1720
Reception	J. B. Lovejoy, Gulf Oil Corporation, Box 1290
Registration	William J. Nolte, Stanolind Oil and Gas Company
Educational exhibits	Herbert H. Bradfield, The Texas Company, Box 1720
Entertainment	David Donoghue, Fort Worth National Bank Bldg.
Publicity	John S. Sparks, Fort Worth <i>Star-Telegram</i>
S.E.P.M.	Gayle Scott, Texas Christian University
S.E.G.	John H. Wilson, Independent Exploration Company

ANNOUNCEMENT

The 28th annual meeting of the American Association of Petroleum Geologists, the 17th annual meeting of the Society of Economic Paleontologists and Mineralogists, and the 13th annual meeting of the Society of Exploration Geophysicists will be held on April 7, 8, and 9, 1943, at the Hotel Texas, Fort Worth, Texas, at the invitation of the Fort Worth Geological Society.

WAR-TIME CONFERENCE

The Office of War Information and Office of Defense Transportation have released a recent statement in which the following is quoted. "Responding to requests for the attitude of the Office of Defense Transportation on the holding of conventions involving inter-city travel, Mr. Eastman said in a formal statement that individual associations must make their own decisions. He indicated, however, that no such gatherings would be justified, in view of war burdens on the transportation systems, unless they would help to shorten the War."

The petroleum requirements for civilian needs, war industries, and Armed Forces are of unquestioned paramount importance in our War program and since the Office of Petroleum Administration for War, and others, have recognized that ample supplies of petroleum and its products are positively necessary for the successful prosecution of the war, and, further, that the replacement of these declining reserves must be maintained by the discovery of new reserves (which at the present time are rather critical), then it is up to the petroleum industry to safeguard these vital requirements by not only the development of present known reserves, but also the diligent and intensified search for new reserves. The petroleum geologists and geophysicists have one of the most important parts to take in this program. With this in mind, the executive committee has decided that the program of our meeting would be mostly restricted to subjects, discussions, and symposiums on the important work that the petroleum geologists and geophysicists can do to assist in carrying out this program to a successful conclusion. So many petroleum geologists and geophysi-



CHAIRMEN OF A.A.P.G. CONVENTION COMMITTEES

Seated, right to left: David Donoghue, entertainment; Karl A. Mygdal, Pure Oil Company, general chairman and president of Fort Worth Geological Society; J. B. Lovejoy, Gulf Oil Corporation, reception; Wm. J. Nolte, Stanolind Oil and Gas Company, registration.

Standing, left to right: Thos. B. Romine, Sinclair Prairie Oil Company, arrangements; John S. Sparks, Jr., publicity; Richard H. Schweers, The Texas Company, finance; Ralph H. Cummins, hotels; H. H. Bradfield, The Texas Company, educational exhibits.

Committee chairmen not shown in photograph: A. I. Levorsen, technical program; Gayle Scott, S.E.P.M. representative; John H. Wilson, S.E.G. representative.

cists have gone into both the Armed Forces and civilian capacities directly connected with the War Effort, that many exploration companies may be handicapped, or at a disadvantage, in their efforts for the discovery of new fields, so that with our limited personnel it is evident that the coöperation of everybody, the exchange of information, and the presentation and discussion of important subjects will be of much assistance to all concerned.

The time for the meeting has been reduced to one day of business meetings and committee conferences and two days of technical sessions. The technical sessions of each forenoon are to continue until 12:30 P.M., in order to avoid too much congestion at the noon meal hour. College groups expecting to hold luncheons should make plans early and arrange with hotels for space in advance.

WAR RESERVES AND DISCOVERIES

Chairman Levorsen, of the technical program, announces that the sessions are to be devoted to War Reserves and Discoveries, and it is planned to eliminate papers of only local interest, except for presentation by title and abstract in the printed program, for subsequent publication in full in the *Bulletin*. Authors are requested to send abstracts to Association Headquarters, Box 979, Tulsa, Oklahoma, by March 1. It may be that opportunity will be offered to deliver a few miscellaneous papers orally at the meeting.

No formal entertainment, no banquet, no dance, no golf tournament, no field trips are planned.

OUTLINE OF PROGRAM

Each day's sessions are outlined as follows.

Wednesday A.M., April 7

Annual business committee

Business meetings of standing and special committees

Wednesday P.M.

Various research committee conferences

Wednesday Night

Research committee: "Discovery Thinking"

Thursday A.M., April 8

Nomination of officers

Presidential addresses

War and Personnel Problems

Reviews of Wildcatting and Geologic Progress

Thursday P.M.

Major addresses by leaders in the oil industry

Thursday Night

Special address and smoker

Friday A.M., April 9

Symposium on Secondary Recovery and Stripper Wells

Friday P.M.

Symposium to focus attention of oil industry on Most Favorable Areas for Wildcatting for War Needs

Annual business meeting

EXHIBITS

Exhibits of exploratory equipment and methods, both field and office, are being planned. Previous oil-field equipment exhibitors, map makers, and others have expressed their desire for space. Reservations for display space should be directed to A.A.P.G. Headquarters, Box 979, Tulsa, Oklahoma.

Strictly educational and scientific exhibits will be displayed as usual. State geological surveys, educational institutions, and geological societies are invited to set up exhibits under supervision and responsibility of their own representatives. Map panels and display tables of limited space will be provided for such exhibits. Requests for space should be sent to A.A.P.G. Headquarters, Box 979, Tulsa, Oklahoma.

HOTELS

Fort Worth is like every other city in the country in that hotel accommodations are generally taxed to near capacity. With this in mind you are urged to do the following.

1.—Hotel reservations should be made *early* by each person directly with the hotel of his choice. Request the hotel for confirmation. The hotel committee, with Ralph H. Cummins, chairman, 1603 Trinity Building, Fort Worth, Texas, will be glad to give advice about hotel accommodations. Members who find they can not attend should promptly cancel any reservations they have made.

2.—It may be necessary to double up in some cases in order to accommodate everyone. Plan to do this if possible.

3.—On account of the transportation and limited hotel accommodations, you are urgently requested to discourage the bringing of non-member guests and wives to the meeting.

THE ASSOCIATION ROUND TABLE

HOTEL TEXAS (Headquarters)

Single.....	\$ 2.25 up
Double.....	3.50 up
Twin beds.....	4.00 up
Suites.....	10.50 up

WESTBROOK HOTEL

(3 blocks from headquarters)

Single.....	\$ 2.25 up
Double.....	3.00 up
Twin beds.....	4.00 up
Suites.....	6.00 up

WORTH HOTEL (3½ blocks from headquarters)

Single.....	\$ 2.75 up
Double.....	4.00 up
Twin beds.....	4.50 up
Suites.....	12.00 up

BLACKSTONE HOTEL

(3 blocks from headquarters)

Single.....	\$ 3.50 up
Double.....	5.00 up
Suites.....	16.00 up

COMMERCIAL (3½ blocks), Single, \$2.00, Double, \$4.00; HICKMAN (7 blocks); MILNER (opp. Hdqtrs.)

TOURIST COURTS

El Patio Lodge, 1815 E. Lancaster, US 80 E.
 Mayo Courts, 1917 E. Lancaster, US 80 E.
 Rockway Court, 5900 Camp Bowie, US 80 W.
 Motor Inn Hotel, 5225 Camp Bowie, US 80 W.

Ft. Worth Tourist Lodge, 5821 Camp Bowie, US 80 W.
 Shady Tour-Res, 4036 E. Belknap, US 377 N.
 Casa Loma, Jacksboro Highway, Texas 199 NW.
 Rockwood Court, Jacksboro Highway, Texas 199 NW.

TENTATIVE SCHEDULE OF EVENTS

A. I. Levorsen, chairman of the technical program committee, announces the following schedule of events, subject to change.

TUESDAY, APRIL 6

AFTERNOON

- 1:00 Registration: A.A.P.G., S.E.P.M., S.E.G. Lobby, Hotel Texas.
 Technical and educational exhibits being set up. Bluebonnet Court, 14th Floor.

WEDNESDAY, APRIL 7

MORNING

- 8:00 Registration. Lobby, Hotel Texas.
 8:00 Exhibits. Bluebonnet Court, 14th Floor.

TECHNICAL SESSIONS

- 9-12:30 S.E.P.M. Technical Session. Cactus Room, 14th Floor.
 9-12:30 S.E.G. Technical Session. Crystal Ball Room, 14th Floor.

BUSINESS COMMITTEE MEETINGS

- 9:30 A.A.P.G. Committee for Publication, J. V. Howell, chm. Room 333.
 A.A.P.G. Research Committee, A. I. Levorsen, chm. Room 325.
 A.A.P.G. Committee on Applications of Geology, Carey Croneis, chm. Room 327.
 A.A.P.G. Committee on College Curricula, F. H. Lahee, chm. Room 331.
 A.A.P.G. National Service Committee, F. L. Aurin, chm. Room 335.
 10:30-12:30 A.A.P.G. Business Committee, D. Perry Olcott, chm. Alamo Room, Mezzanine.
 12:30 S.E.G. Luncheon. Speaker, Paul Weaver. The Den.

AFTERNOON

- 2-5:00 S.E.P.M. Technical Session. Cactus Room, 14th Floor.
 S.E.G. Technical Session. Crystal Ball Room, 14th Floor.
 A.A.P.G. Business Committee. Alamo Room, Mezzanine.

RESEARCH COMMITTEE CONFERENCE GROUPS

- Origin of Oil, M. G. Cheney and Wendell P. Rand, co-leaders. Room 331. Discussion of A.P.I. Research Committee Project 43.
 Migration and Accumulation of Oil, F. M. Van Tuyl and Ben H. Parker, co-leaders. Oak Room, Mezzanine. Final report prepared by W. W. Skeeters and the co-leaders.
 Sedimentation, F. W. Rolshausen and W. C. Krumbein, co-leaders. Centennial Room No. 1, Mezzanine. Continental sediments, definition, identification from well-cuttings, and relation to occurrence of oil and gas.
 Oil-Field Waters, L. C. Case and Walter R. Berger, co-leaders. Room 327. Oil-field waters of West Texas and southeast New Mexico.
 Estimating Reserves and Appraisal of Oil and Gas Leases, Lewis W. MacNaughton and Harry F. Wright, co-leaders. Centennial Room No. 2, Mezzanine.

THE ASSOCIATION ROUND TABLE

321

EVENING

- 8-10:00 A.A.P.G. Research Committee Open Meeting.
Crystal Ball Room, 14th Floor. Survey of Geology Students, A. I. Levorsen.
Discovery Thinking, A. I. Levorsen.

THURSDAY, APRIL 8

MORNING

- 8:00 Registration. Lobby, Hotel Texas.
8:00 Ballot Boxes open until 5:00 P.M., A.A.P.G. Headquarters Booth. Lobby, Hotel Texas.
8:00 Exhibits. Bluebonnet Court, 14th Floor.
8-9:00 A.A.P.G. Geologic Names Committee, J. G. Bartram, chm. Breakfast meeting, Oak Room, Mezzanine.
9-10:00 A.A.P.G. Business Meeting, Nomination of Officers, F. L. Aurin, chm. Crystal Ball Room, 14th Floor.
10-12:30 Joint Technical Session. Crystal Ball Room, 14th Floor. Presidential addresses, personnel and war problems, surveys and reviews of 1942 activities. Speakers: F. L. Aurin, K. C. Heald, Frank Goldstone, F. H. Lahee, F. M. Van Tuyl, and Hugh Miser.

AFTERNOON

- 2-5:00 Joint Technical Session. Crystal Ball Room, 14th Floor. Speakers: E. DeGolyer, R. J. Gonzales, W. B. Heroy, L. F. McCollum.

EVENING

- 8-9:00 Address by Claude E. Z. Bell. Scripps Institution of Oceanography, LaJolla, California. Crystal Ball Room, 14th Floor.
9-11:30 Smoker given by Fort Worth Geological Society.

FRIDAY, APRIL 9

MORNING

- 8:00 Registration. Lobby, Hotel Texas.
8:00 Exhibits. Bluebonnet Court, 14th Floor.
9:00 A.A.P.G. Distinguished Lecture Committee, J. L. Ferguson, chm. Oak Room, Mezzanine.
9:30 Joint Technical Session. Crystal Ball Room. Symposium on Secondary Recovery and Stripper Wells, with particular reference to geological factors. Speakers: Paul D. Torrey, C. P. McGaha, George R. Elliott, R. C. Earllougher, George H. Fancher, Paul E. Fitzgerald.

AFTERNOON

- 2-4:00 Joint Technical Session. Crystal Ball Room, 14th Floor.
Symposium on Favorable Areas for Wildcatting for War Needs. Speakers:
Max L. Krueger, Pacific Coast States;
C. E. Dobbin, Rocky Mountain States;
O. L. Brace, Gulf Coast and South Mid-Continent;
J. V. Howell, North Mid-Continent and Eastern Region.
A meeting to focus the attention of the oil industry on the areas offering the greatest returns for wildcatting in order to develop new supplies for war needs. Each speaker is chairman of a committee studying various factors in each producing area, and the symposium consists of their reports and a discussion of them.
4-5:00 A.A.P.G. Annual Business Meeting. F. L. Aurin, chm. Crystal Ball Room, 14th Floor. Reports of officers and committees. Announcement of election of officers.

The Division of Paleontology and Mineralogy is arranging a program according to the following schedule under the guidance of its program committee composed of Gayle Scott, chairman, Fort Worth; R. Wright Barker, Houston; Charles W. Honess, Evansville, Indiana; W. H. Twenhofel, University of Wisconsin, Madison; and Stanley G. Wissler, Los Angeles.

1. A symposium of the different fields of geology as aids to the discovery of petroleum. Directed by W. H. Twenhofel.

- (1) Aid of sedimentary petrology to the discovery of oil—Raymond Sidwell, Lubbock, Texas.
- (2) Aid of paleogeography to the discovery of petroleum—John Emery Adams, Midland, Texas.
- (3) Aid of stratigraphy to the discovery of petroleum—H. B. Stenzel, Austin, Texas.

THE ASSOCIATION ROUND TABLE

- (4) Aid of paleontology to the discovery of petroleum—Henry V. Howe, Baton Rouge, Louisiana.
 2. Problems of sedimentation in relation to the finding of oil—Parker D. Trask, Washington, D. C.
 3. The teaching of paleontology—C. E. Decker, Norman, Oklahoma.
 4. Subsurface micropaleontological zonations in the Tertiary of Texas and Louisiana—S. W. Lowman, Houston, Texas.
 5. New Washita Foraminifera—Lt. Alfred R. Loeblich and Helen Tappan, New Orleans, Louisiana.
 6. Cambrian graptolites of Wisconsin and Minnesota—C. E. Decker, Norman, Oklahoma.
 7. Pendent graptolites in Oklahoma, Arkansas and Texas—C. E. Decker, Norman, Oklahoma.
- Business meeting.

THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS MEMBERSHIP LIST¹

MARCH 1, 1943

HONORARY MEMBERS

The executive committee may from time to time elect as honorary members persons who have contributed distinguished service to the cause of petroleum geology. Honorary members shall not be required to pay dues.—*Sec. 6, Article III, of the Constitution.*

LIFE MEMBERS

The executive committee may grant life membership to members who have paid their dues and are otherwise qualified.—*Sec. 2, Article III, of the Constitution.*

On the payment of two hundred dollars (\$200.00) any member in good standing shall be declared a life member and thereafter shall not be required to pay annual dues.—*Sec. 2, Article I, of the By-Laws.*

MEMBERS

Any person engaged in the work of petroleum geology or in research pertaining to petroleum geology or technology is eligible to active membership, provided he is a graduate of an institution of collegiate standing, in which institution he has done his major work in geology, or in sciences fundamental to petroleum geology, and in addition has had the equivalent of three years' experience in petroleum geology or in the application of these other sciences to petroleum geology or to research in petroleum geology or technology; and provided further that in the case of an applicant for membership who has not had the required collegiate or university training, but whose standing in the profession is well recognized, he shall be admitted to membership when his application shall have been favorably and unanimously acted upon by the executive committee, and provided further that these requirements shall not be construed to exclude teachers and research workers in recognized institutions whose work is of such character as in the opinion of the executive committee shall qualify them for membership.

Active members alone shall be known as members.—*Sec. 1, Article III, of the Constitution.*

ASSOCIATES

Any person having completed as much as thirty hours of geology (an hour shall here be interpreted as meaning as much as sixteen recitation or lecture periods of one hour each, or the equivalent in laboratory) in a reputable institution of collegiate or university standing, or who has done field work equivalent to this, is eligible to associate membership, provided at the time of his application for membership he shall be engaged in geological studies in an institution of collegiate or university standing, or shall be engaged in petroleum geology; and any person who is a graduate of an institution of collegiate standing, in which he has done his major work in sciences fundamental to petroleum geology or petroleum technology, and who has had the equivalent of one year's experience in the application of his science to the study of petroleum geology, shall be eligible to associate membership, provided at the time of his application for membership he shall be engaged in investigations in the broader subject of petroleum geology and technology.

Associate members shall be known as associates.

Associates shall enjoy all the privileges of membership in the Association, save that they shall not hold office, sign applications for membership, or vote; neither shall they have the privilege of advertising their affiliation with the Association in professional cards or professional reports or otherwise.—*Sec. 3, Article III, of the Constitution.*

¹ This list is published for the use of the members and for the information of all who wish to refer to the professional and business affiliations of the members. It is not a mailing address list and it is not intended to be used for circularizing or soliciting purposes.

HONORARY MEMBERS

- **Campbell, Marius R.
 Darton, N. H., U. S. Geological Survey, Washington, D. C.
 Decker, Charles E., University of Oklahoma, Norman, Okla.
 **Dumble, E. T.
 Goodrich, Harold B., 1628 S. Cincinnati, Tulsa, Okla.
 Harris, Gilbert D., Dept. of Geology, Cornell University, Ithaca, N. Y.
 **Hill, Robert T.
 Lawson, Andrew C., University of California, Bacon Hall, Berkeley, Calif.
 Mendenhall, Walter C., U. S. Geological Survey, Washington, D. C.
 **Orcutt, W. W.
 Ordoñez, Ezequiel, Abraham Gonzalez, 79, Mexico City, Mexico
 **Reed, Ralph D.
 **Salisbury, R. D.
 **Schuchert, Charles
 Smith, George Otis, Box 308, Skowhegan, Me.
 Stille, Hans, Geological Institute, University of Berlin, Berlin, Germany
 Taff, Joseph A., 628 Cowper St., Palo Alto, Calif.
 **Udden, Johan August
 Ulrich, E. O., National Museum, Washington, D. C.
 van der Gracht, W. A. J. M., 36 Euwige Laan, Huize Jachtduin, Bergen (N. H.), Netherlands
 **von Hofer, Hans Hofrat
 **White, David
 **White, I. C.
 Woolnough, W. G., "Callabonna," 8 Park Ave., Gordon, N.S.W., Australia

** Deceased.

COMPLETE LIST OF MEMBERS, ASSOCIATES, HONORARY
 MEMBERS, AND LIFE MEMBERS

Honorary.....	13
Life.....	7
Members.....	3,039
Associates.....	864
Total.....	3,923

EXPLANATION OF SYMBOLS

*Honorary member. † Life member. ‖ Associate. Members are not marked. The year refers to the date of election to membership.

Abbey, Gerald Ellsworth, c/o Charles O. Abbey, Rt. 1, Platte City, Mo.	42
Abbot, Wayne Rosser, 3435 Edgemont Pl, Wichita, Kan.	42
Abbott, John L., Pritchard & Abbott, Century Bldg., Fort Worth, Tex.	27
Abell, George T., independent, Box 430, Midland, Tex.	29
Abernathy, George Elmer, Kansas Geol. Survey, Pittsburg, Kan.	38
Absher, Kenneth B., independent, 125 Mandalay Dr., E., San Antonio, Tex.	25
Absher, William F., Cities Service Oil Co., Bartlesville, Okla.	20
Acheson, Cyrus Harold, Tropical Oil Co., El Centro, Colombia, S. A.	39
Achning, Walter J., Rt. 1, Box 51, Colorado Springs, Colo.	38
Ackerman, Edgar Dumont, Standard Oil Co. of Venezuela, Caripito, Venezuela, S. A.	40
Ackers, A. L., Stanolind Oil & Gas Co., Box 591, Tulsa, Okla.	25
Ackley, Kenneth A., Carter Oil Co., 912 Louisiana Natl. Bank Bldg., Baton Rouge, La.	38
Acosta-Sarmiento, Gonzalo, Carrera 13-A, No. 23-52, Bogota, Colombia, S. A.	42
Adams, Bradford Clarendon, Box 528, Los Banos, Calif.	41
Adams, Clyde B., 93 Paul Revere Rd., Needham Heights, Mass.	41
Adams, Elmo W., Honolulu Oil Corp., 215 Market St., San Francisco, Calif.	30
Adams, Frank C., consulting, 4814 Yoakam Blvd., Houston, Tex.	27
Adams, John Emery, Standard Oil Co. of Texas, Carlsbad, N. Mex.	20
Adams, Kilburn Elie, Jr., 406 N. Travis, Lamesa, Tex.	38
Adams, Robert James, Box 150, Denton, Tex.	42

Adams, Robert Wiley, Box 664, Reseda, Calif.	42
Adams, W. C., Box 1666, Houston, Tex.	24
Addison, Carl C., Pure Oil Co., 402 Second Natl. Bank Bldg., Saginaw, Mich.	30
Adkins, W. S., Shell Oil Co., Inc., Box 2099, Houston, Tex.	20
Adkisson, Albert W., independent, 2019 W. T. Waggoner Bldg., Fort Worth, Tex.	34
Adler, Joseph L., 901 Esperson Bldg., Houston, Tex.	30
Afshar, Freydoun Azadi, 6107 Ingleside Ave., Chicago, Ill.	39
Agee, Flint Humphrey, Box 548, Thibodaux, La.	38
Agey, Charles Samuel, Amerada Petr. Corp., Box 995, Wichita, Kan.	38
Agnich, Fred J., Geophysical Service, Inc., 1311 Republic Bank Bldg., Dallas, Tex.	41
Aguerrevere, Pedro I., Apt. 1253, Caracas, Venezuela, S. A.	24
Aguerrevere, Santiago E., Sur 3, No. 94, Caracas, Venezuela, S. A.	24
Aimer, James D., Arkansas Nat. Gas Corp., Drawer 1734, Shreveport, La.	26
Ainsworth, David, 221 N. Pine Crest, Wichita, Kan.	23
Aitken, William Ernest, Apt. Postal 2760, Bogota, Colombia, S. A.	32
Akers, Wilburn Holt, 1029 S. W. Twenty-eighth St., Oklahoma City, Okla.	41
Akkerman, Richard Pete, Sheffield Steel Corp., Houston, Tex.	41
Alagood, Robert Henson, Pure Oil Co., Box 479, Corpus Christi, Tex.	39
Albert, Emil Richard, Jr., Baroid Sales Div., Natl. Lead Co., 502 Tulsa Bldg., Tulsa, Okla.	42
Albertson, Maurice M., Shell Oil Co., Inc., Box 2099, Houston, Tex.	20
Albritton, Claude Carroll, Jr., U. S. Geol. Survey, Dallas, Tex.	39
Alcorn, Avary Hunt, Atlantic Refg. Co., 1742 Milam Bldg., San Antonio, Tex.	32
Alcorn, James Munrex, 5527 Richard Ave., Dallas, Tex.	42
Alexander, C. I., Geol. Dept., Magnolia Petr. Co., Tyler, Tex.	27
Alexander, Clyde Wayne, Phillips Petr. Co., Box 1729, Shreveport, La.	38
Alexander, Walter Herbert, Jr., 511 W. Tenth St., Plainview, Tex.	42
Allan, John Andrew, Univ. of Alberta, Edmonton, Alta., Canada.	30
Allan, Thomas H., 921 Union Natl. Bank Bldg., Wichita, Kan.	24
Allardyce, Robert Edward Lee, Jr., Lone Star Ordnance, Texarkana, Tex.	42
Allen, Alton C., Rowan & Nichols Oil Co., 903 Trinity Bldg., Fort Worth, Tex.	35
Allen, Bryant W., Gulf Oil Corp., Box 778, Tyler, Tex.	25
Allen, Charles Francis, 1416 Eleventh St., Apt. 13, Sacramento, Calif.	42
Allen, Devere, F., 3000 Sowers Court, Topeka, Kan.	29
Allen, Donald M., Westgate-Greenland Oil Co., 1022 Union Natl. Bank Bldg., Wichita, Kan.	24
Allen, E. G., 4601 Park Lane, Dallas, Tex.	17
Allen, Frank Tilbury, Gulf Research & Dev. Co., Box 2038, Pittsburgh, Pa.	39
Allen, Harris Hayes, Phillips Petr. Co., Bartlesville, Okla.	39
Allen, John O., Apt. 172, Maracaibo, Venezuela, S. A.	41
Allen, Stanley R., 202 Humble Bldg., Houston, Tex.	35
Allen, William Hammond, G-3 Section, 7th Motorized Div., Desert Maneuvers A.P.O. 7, c/o Postmaster, Los Angeles, Calif.	40
Allen, William Odis, Jr., 1331 E. Twenty-sixth St., Tulsa, Okla.	39
Allison, A. P., Sun Oil Co., Box 2645, Houston, Tex.	21
Allon, Meyer Michael, Box 487, Guthrie Okla.	37
Alquist, Francis Nelson, Dow Chemical Co., Midland, Mich.	38
Alvarado, Benjamin, Ministerio de la Economia, Carrera 13, No. 15-30, Bogota, Colombia, S. A.	38
Alvarez, Manuel, Jr., Ignacio Mariscal 12-A, Mexico, D. F., Mex.	36
Ambrose, A. W., Cities Service Oil Co., Bartlesville, Okla.	19
Ames, Edward W., consulting, Box 921, Denver, Colo.	19
Andersen, Harold V., 1800 Eleventh Ave., S., Birmingham, Ala.	40
Anderson, Carl B., Gulf Refg. Co., Box 482, Mattoon, Ill.	19
Anderson, Carl C., U. S. Bureau of Mines, Box 2250, Amarillo, Tex.	32
Anderson, Carl T., Republic Nat. Gas Co., 1505 Federal St., Dallas, Tex.	41
Anderson, Frank M., 58 Hill Crest Rd., Berkeley, Calif.	24
Anderson, Frank Marion, 1635 Pine St., Dallas, Tex.	42
Anderson, George Harold, Lone Star Steel Co., Daingerfield, Tex.	40
Anderson, Jack Q., Tremont Hotel, Red Bluff, Calif.	40
Anderson, James Burt, Engineer School, 15 Flagler Hall, Fort Belvoir, Va.	38
Anderson, John G., Jr., 815 Chronicle Bldg., Houston, Tex.	21
Anderson, Kenneth Clyde, 4040 Warwick, Kansas City, Mo.	42
Anderson, Oscar Samuel, Jr., Big Four Petr. Co., Box A, Oilton, Okla.	39
Anderson, Ray Ball, Columbian Carbon Co., Box 873, Charleston, W. Va.	24
Anderson, Richard Jasper, 446 State Capitol, Little Rock, Ark.	42
Anderson, Robert G., Box 924, Coleman, Tex.	38

Anderson, Rudolph Faraday, Gulf Refg. Co., Box 482, Mattoon, Ill.	42
Anderson, Thomas Corwin Iliff, 2250 Parnell Ave., W. Los Angeles, Calif.	40
Anderson, Tom A., Box 182, Madelia, Minn.	36
Anderson, Warren D., Amerada Petr. Corp., Box 591, Midland, Tex.	27
Andrau, Evert Willem Karel, consulting, Box 2408, Houston, Tex.	32
Andrews, Philip, Socony-Vacuum Oil Co., Apt. 1140, Bogota, Colombia, S. A.	25
Andrews, Thomas Gayle, Univ. of Alabama, University, Ala.	37
Andrews, Wilton W., Humble Oil & Refg. Co., Box 2180, Houston, Tex.	36
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Arick, Millard B., Midland, Tex.	27
Arleth, Karl, 2215 El Molino Pl., San Marino, Calif.	39
Armstrong, Earle N., Shamrock Oil & Gas Corp., Amarillo, Tex.	33
Armstrong, Harold K., 508 E. Mendocino St., Altadena, Calif.	27
Armstrong, J. M., consulting, Box 909, Midland, Tex.	18
Armstrong, Ursel Sidney, Shell Oil Co., Inc., Long Beach, Calif.	42
Arnold, Emmett L., A.P.O. 828, c/o Postmaster, New Orleans, La.	27
Arnold, Harry H., Jr., 131 Seventh Ave., Clarion, Pa.	27
Arnold, Henry C., British-American Oil Prod. Co., 505 Philtower Bldg., Tulsa, Okla.	30
Arnold, Lincoln Merchant, Geologic Standards Co., 321 S. Detroit, Tulsa, Okla.	39
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Ashley, Richard Moore, Box 871, Midland, Tex.	39
Athy, Lawrence F., Geophysical Div., Continental Oil Co., Ponca City, Okla.	26
Atwater, Gordon I., c/o William Helis, 912 Whitney Bldg., New Orleans, La.	38
Atwill, E. R., Union Oil Co. of Calif., 617 W. Seventh St., Los Angeles, Calif.	31
Augenthaler, Robert Lewis, Standard Oil Co., of British Columbia, 700 Lancaster Bldg., Calgary, Alta., Canada.	38
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Aurin, Fritz L., Southland Royalty Co., 1607 Trinity Bldg., Fort Worth, Tex.	17
Austin, Robert Burton, 631 W. Fifty-ninth St., Kansas City, Mo.	41
Autry, Vernon E., Fain-McGaha Oil Corp., 607 Hamilton Bldg., Wichita Falls, Tex.	26
Avery, C. Dwight, U. S. Geol. Survey, 3240 Interior Bldg., N., Washington, D. C.	28
Aycock, Lester Charles, Louisiana Geol. Survey, Univ. Station, Baton Rouge, La.	41
Ayers, Floyd M., c/o R. M. Hurt, International Petr. Co., Ltd., Guayaquil, Ecuador, S. A.	30
Babin, Logan Henry, 3930 Prytania St., New Orleans, La.	38
Bace, A. C., Stanolind Oil & Gas Co., Stanolind Bldg., Tulsa, Okla.	24
Bachman, Ford Frederick, o-375608, Hq. Co., Third Army Corps, A.P.O. 303, Fort McPherson, Ga.	41
Back, Denys Howard, Yuan Dev. Co., 1422 Esperson Bldg., Houston, Tex.	37
Backman, John Edward, Gulf Research & Dev. Co., Box 2038, Pittsburgh, Pa.	39
Bacon, Charles S., Jr., U. S. Geol. Survey, Prescott, Ariz.	29
Baddley, Elmer R., The Texas Co., Los Angeles, Calif.	36
Bader, Glenn Ernest, Humble Oil & Refg. Co., 802 Humble Bldg., Houston, Tex.	34
Baer, Daurice Frank, c/o Jasper A. Baer, Monticello, Ind.	42
Baggelaar, Hermanus, United British Oilfields of Trinidad, Ltd., Point Fortin, Trinidad, B.W.I.	42
Bailey, James P., Standard Oil Co. of Calif., 605 W. Olympic Blvd., Los Angeles, Calif.	31
Bailey, John James, Argo Oil Co., 211½ N. Colorado, Midland, Tex.	37
Bailey, Thomas L., Shell Oil Co., Inc., Box 2099, Houston, Tex.	24
Bailey, Willard F., Skelly Oil Co., 505 First Natl. Bank Bldg., Midland, Tex.	35
Bain, H. Foster, c/o Bureau of Mines, Manila, P. I.	26
Baird, Chester A., Mene Grande Oil Co., Apt. 709, Caracas, Venezuela, S. A.	21
Baker, Arthur A., U. S. Geol. Survey, Washington, D. C.	30
Baker, Norval E., Petroleum Administration for War, Rm. 1104, 122 E. Forty-second St., New York, N. Y.	27
Baker, Raymond F., Geol. Dept., The Texas Co., 135 E. Forty-second St., New York, N. Y.	17
Baker, William A., Jr., consulting, 1515 Esperson Bldg., Houston, Tex.	24
Bakke, W. E., First Natl. Bank, St. Louis, Mo.	28

Baldwin, Benjamin Franklin, Stanolind Oil & Gas Co., Topeka, Kan.....	39
Baldwin, E. B., consulting, Esperson Bldg., Houston, Tex.....	29
Bale, Hubert E., consulting, 220 N. W. Thirty-first St., Oklahoma City, Okla.....	24
Ball, John Rice, Dept. of Geol., Northwestern Univ., Evanston, Ill.....	40
Ball, Max W., Abasand Oils, Ltd., Credit Foncier Bldg., Edmonton, Alta., Canada.....	19
Ballantyne, Richard Stewart, Jr., 1530 S. Van Ness Ave., Los Angeles, Calif.....	40
Ballard, Gene, Seaboard Oil Co., Box 396, Kerman, Calif.....	40
Ballard, James L., Tide Water Assoc. Oil Co., 602 Driscoll Bldg., Corpus Christi, Tex.....	25
Ballard, William Norval, 1105 N. E. Twentieth, Oklahoma City, Okla.....	29
Baltrusaitis, Edward Joseph, Gulf Refg. Co., Box 811, Saginaw, Mich.....	40
Banks, Thomas R., 921 Cambridge Oval, San Antonio, Tex.....	27
Banta, Henry Eugene, 1922 W. Gray, Houston, Tex.....	40
Barbat, William F., Prod. Dept., Standard Oil Co., Taft, Calif.....	28
Barber, Clifford Fountain, 1217 Commerce Bldg., Houston, Tex.....	37
Barbour, Richard Morton, consulting, 129 E. Riverside Dr., Evansville, Ind.....	40
Barclay, Stewart, Geophysical Div., Phillips Petr. Co., Bartlesville, Okla.....	39
Bard, Richards J., N.K.P.M. Pendopo, Soengei Gerong, Palembang, Sumatra, Netherlands Indies.....	28
Barger, Thomas Charles, California Arabian Standard Oil Co., Bahrain Island, Persian Gulf.....	40
Barker, Maurice Hubert Stucley, The Market Pl., Tetbury, Gloucestershire, England.....	42
Barling, Robert, Miller Geophysical Co., Box 185, Woodland, Calif.....	27
Barlow, Victor, Burneol Petr. Co., 812 Subway Terminal Bldg., Los Angeles, Calif.....	27
Barnes, Augustine Edward, Jr., The Ohio Oil Co., Box 529, Owensboro, Ky.....	42
Barnes, Chester Franklin, Box 266, Big Spring, Tex.....	35
Barnes, Roy M., Continental Oil Co., Edison Bldg., 601 W. Fifth St., Los Angeles, Calif.....	24
Barnes, Sydney Urbane, 1720 1/2 N. Gower, Hollywood, Calif.....	41
Barnett, D. G., Geol. Dept., Union Prod. Co., Beeville, Tex.....	25
Barnett, John Abner, U. S. Geol. Survey, Roswell, N. Mex.....	28
Barnett, John F., Jr., Palacios, Tex.....	39
Barney, Arthur Y., Box 873, Charleston, W. Va.....	30
Barnhart, Carl F., Amerada Petr. Corp., Box 591, Midland, Tex.....	29
Barnwell, George F., New Zealand Petr. Co., Box 295, Gisborne, N. Z.....	28
Barr, Kenneth William, Trinidad Leaseholds, Ltd., Pointe-a-Pierre, Trinidad, B.W.I.....	39
Barragy, Edward J., Woodley Petr. Co., Second Natl. Bank Bldg., Houston, Tex.....	31
Barret, William Morris, c/o William M. Barret, Inc., Giddens-Lane Bldg., Shreveport, La.....	32
Barrett, Albert F., General Petr. Corp., Casper, Wyo.....	30
Barrett, Henry Haldred, Carter Oil Co., Box 1151, Seminole, Okla.....	41
Barrett, John Frederick, Rt. 2, Rockford, Ill.....	40
Barrow, Geoffrey, Tropical Oil Co., El Centro, Colombia, S. A.....	31
Barrow, Leonidas T., Humble Oil & Refg. Co., Houston, Tex.....	22
Barry, John O'Keefe, 701 Meriam St., Plaquemine, La.....	41
Bartell, Laurence D., Skelly Oil Co., 419 Ardis Bldg., Shreveport, La.....	27
Bartle, Glenn G., 5604 Holmes St., Kansas City, Mo.....	27
Bartlett, C. Lothrop, Sun Oil Co., Box 2831, Beaumont, Tex.....	28
Bartlett, Fred W., c/o William Bartlett, A.R.F.D. 2, Syracuse, N. Y.....	24
Bartley, Jerald Howard, Box 2053, Glen Rose, Tex.....	39
Barton, Jack M., Magnolia Petr. Co., Box 633, Midland, Tex.....	38
Barton, Louis A., Arkansas Louisiana Gas Co., 1128 Slattery Bldg., Shreveport, La.....	20
Bartosh, Edmund J., Bankline Oil Co., 437 S. Hill St., Los Angeles, Calif.....	28
Bartram, John G., Stanolind Oil & Gas Co., Box 591, Tulsa, Okla.....	17
Bartram, Paul L., Phillips Petr. Co., Box 958, Ardmore, Okla.....	27
Barwick, John S., 793 Union Natl. Bank Bldg., Wichita, Kan.....	24
Bass, Nathan W., U. S. Geol. Survey, Box 311, Tulsa, Okla.....	25
Bass, Perry R., 2106 Fort Worth Natl. Bank Bldg., Fort Worth, Tex.....	36
Bateman, Alan M., Yale Univ., Drawer 91-A, Yale Station, New Haven, Conn.....	20
Bateman, Andrew Frank, Jr., 922 Engr. Regt., Geiger Field, Wash.....	36
Bateman, Paul C., U. S. Geol. Survey, Palo Alto, Calif.....	42
Bates, Charles Carpenter, 10912 1/2 Wellworth, Village Station, Los Angeles, Calif.....	40
Bates, Fred Westerman, Box 175, Lafayette, La.....	36
Bates, R. P., independent, Springer Bldg., Tulsa, Okla.....	30
Bates, Robert Latimer, New Mexico School of Mines, Socorro, N. Mex.....	40
Batla, Thomas Woodrow, Bellville, Tex.....	41
Bauerschmidt, A. J., Jr., Magnolia Petr. Co., Box 426, Vanderbilt, Tex.....	27
Baughman, George W., Cessna Aircraft Co., Wichita, Kan.....	36

Baumeister, Dorothy, Skelly Oil Co., Wichita, Kan.....	42
Baxter, John C., 605th CA (AA), Camp Stewart, Ga.....	42
Bay, Harry X., The Texas Co., Box 2332, Houston, Tex.....	30
Bayer, H. M., Gulf Oil Corp., Midland, Tex.....	25
Bayles, Robert Ellery, Peoples Nat. Gas Co., 545 William Penn Way, Pittsburgh, Pa.....	42
Baysinger, Eugene M., 911th Engr. Hdqtrs. Co., MacDill Field, Tampa, Fla.....	36
Bazhaw, Willis Oliver, 320 W. Dewey St., Shawnee, Okla.....	42
Beach, Hugh Hamilton, Geological Survey, Victoria Museum, Ottawa, Ont., Canada.....	41
Beach, John Hartwell, Shell Oil Co., Inc., Box 999, Bakersfield, Calif.....	37
Beal, Carl H., consulting, 5658 Wilshire Blvd., Los Angeles, Calif.....	19
Beal, Carlton, 163 Granville Ave., W. Los Angeles, Calif.....	39
Bean, Ward C., Shell Oil Co., Inc., Wichita Falls, Tex.....	18
Bear, Melvern Fred, Sharon Drilling Co., 204 Derby Bldg., Wichita, Kan.....	36
Beardsley, William R., Interstate Gas Co., Box 1087, Colorado Springs, Colo.....	40
Beatty, Robert M., 2002 Calumet, Houston, Tex.....	27
Beck, August F., Geophysical Dept., Cities Service Oil Co., Bartlesville, Okla.....	27
Beck, Elfred, 717 McBirney Bldg., Tulsa, Okla.....	20
Beck, R. Stanley, Richfield Oil Corp., Box 1710, Bakersfield, Calif.....	38
Beck, Robert W., Carter Oil Co., Drawer 1739, Shreveport, La.....	36
Beckelhymer, Roy L., Union Prod. Co., Box 2492, Houston, Tex.....	26
Becker, Dwight Lyman, Amerada Petr. Corp., Drawer 2040, Tulsa, Okla.....	38
Becker, Herman Carroll, Seismograph Service Corp., 709 Kennedy Bldg., Tulsa, Okla.....	38
Becker, Leroy Everett, 537 Lincoln St., Princeton, Ill.....	42
Becker, Raymond C., Union Prod. Co., Box 1407, Shreveport, La.....	38
Beckman, Michael William, Continental Oil Co., Box 569, Lafayette, La.....	43
Beckmann, Harry LeRoy, Humble Oil & Refg. Co., Box 1600, Midland, Tex.....	42
Beckmann, Lawrence J., Standard Oil Co. of Venezuela, Caripito, Estado Monagas, Venezuela, S. A.....	38
Beckwith, R. H., 1421 Sheridan St., Laramie, Wyo.....	38
Bediz, Pertev I., 458 Beacon St., Boston, Mass.....	43
Bednar, William Carr, 930 Lahoma Ave., Norman, Okla.....	40
Beebe, B. W., Bay Petr. Corp., Wichita, Kan.....	37
Becker, Ralph E., Pure Oil Co., Saginaw, Mich.....	41
Beekly, Albert L., Mid-Continent Petr. Corp., Box 381, Tulsa, Okla.....	19
Beers, Roland F., Research Laboratory, Geotechnical Corp., Box M, Lincoln, Mass.....	31
Behre, Charles H., Jr., Dept. of Geol., Columbia Univ., New York, N. Y.....	29
Beilharz, Carl F., Pure Oil Co., Box 239, Houston, Tex.....	27
Belknap, Ralph L., Univ. of Michigan, Ann Arbor, Mich.....	31
Bell, A. Lyndon, International Petr. Co., Ltd., Negritos, Peru, S. A.....	36
Bell, Alfred H., State Geological Survey, Urbana, Ill.....	28
Bell, Douglas E., Humble Oil & Refg. Co., Houston, Tex.....	36
Bell, Frank W., Shell Oil Co., Inc., Box 162, W. Sacramento, Calif.....	20
Bell, Harry Wesley, c/o Minerals Div., Capitol Bldg., Baton Rouge, La.....	22
Bell, Olin G., 5519 Jackson St., Houston, Tex.....	20
Belt, Ben C., Gulf Oil Corp., Drawer 2100, Houston, Tex.....	19
Belt, Walter Edwin, Jr., 914 W. Twenty-second St., Austin, Tex.....	43
Bemis, Harold C., Standard Oil Co. of Calif., Whittier, Calif.....	39
Benedum, Darwin, 1142 Milam Bldg., San Antonio, Tex.....	27
Benish, Robert Lowell, Atlantic Refg. Co., Box 1346, Houston, Tex.....	39
Bennett, Frank Orville, Coralena Oil Co., 929 Kennedy Bldg., Tulsa, Okla.....	41
Bennett, Malcolm Dorden, Jr., Continental Oil Co., Houston, Tex.....	39
Bennett, Robert Turner, Mt. Vernon, Iowa.....	41
Benson, Dale L., Sinclair Prairie Oil Co., Box 480, Corpus Christi, Tex.....	25
Benson, Don G., Sinclair Prairie Oil Co., Box 2411, Houston, Tex.....	31
Benton, Louis B., 3332 Ryan Ave., Fort Worth, Tex.....	20
Benzley, James C., Box 274, Bakersfield, Calif.....	42
Berg, Ernest L., Standard Oil Co. of Calif., Rm. 623, 605 W. Olympic Blvd., Los Angeles, Calif.....	43
Berg, Gilman A., Standard Oil Co. of Texas, Box 1249, Houston, Tex.....	38
Berg, Karl A. E., Northern Pacific Ry., 508 Securities Bldg., Billings, Mont.....	41
Berger, Walter R., c/o Cummins & Berger, 1603 Trinity Bldg., Fort Worth, Tex.....	17
Bermudez, Pedro Joaquin, Dominican Seaboard Oil Co., Inc., Ciudad Trujillo, Dominican Republic, C. A.....	42
Bernard, Hugh Allen, Southwestern Institute, Box 474, Lafayette, La.....	40
Bernard, W. E., Gulf Oil Corp., Box 661, Tulsa, Okla.....	21

Bernoulli, W., Geol. Dept., Museum of Nat. History, Basle, Switzerland.....	24
Bernt, Daniel Martin, Jr., 621 N. Sycamore Dr., San Gabriel, Calif.....	37
Berry, George F., Jr., Cities Service Oil Co., Eldorado, Kan.....	36
Berryman, Raymond J., The Ohio Oil Co., Box 193, Bakersfield, Calif.....	42
Berwald, W. B., The Ohio Oil Co., Box 981, Tulsa, Okla.....	23
Berwick, James D., Imperial Oil Co., 56 Church St., Toronto, Ont., Canada.....	36
Bescher, Earl, Jr., A.C.T.D., Corsicana, Tex.....	41
Best, J. Boyd, Petroleum Administration for War, Mellie Esperson Bldg., Houston, Tex.....	21
Beuck, William Frederick, International Petr. Co., Box 803, Guayaquil, Ecuador, S. A.....	42
Bevier, George M., Security Bldg., Pasadena, Calif.....	21
Bierman, Alfred C., consulting, 821 S. Robertson Ave., Tyler, Tex.....	19
Billings, Martin Hewett, c/o Nonmetal Economics Div., U. S. Bureau of Mines, Dept. of the Interior, Washington, D. C.....	38
Billingsley, J. E., West Virginia Gas Corp., Box 1433, Charleston, W. Va.....	30
Bingham, Dwight H., Phillips Petr. Co., Levy Bldg., Lafayette, La.....	21
Bingman, Neal J., Amerada Petr. Corp., Box 591, Midland, Tex.....	30
Birembaut, Arthur, Section Geologique du H. C., Beyrouth (Liban).....	41
Birk, Ralph A., Bridwell Oil Co., 814 City Natl. Bank Bldg., Wichita Falls, Tex.....	20
Birkhauser, Max, Shell Oil Co., Inc., San Marino, Calif.....	26
Bisbee, Wallace Alexander, 242 W. Tenth, Bristow, Okla.....	40
Bishop, Bradford, Bradford Bishop, Inc., S. Pasadena, Calif.....	36
Bishop, Francis Luther, Geophysical Service, Inc., 1813 Natl. Bank of Tulsa Bldg., Tulsa, Okla.....	40
Bishop, Margaret Stearns, 203 S. East St., Cassopolis, Mich.....	38
Bivens, Wilmer Edward, Jr., 209 Primera Dr., San Antonio, Tex.....	41
Black, Jo Pat, 1810 Petroleum Bldg., Houston, Tex.....	32
Blackburn, Willis C., Humble Oil & Refg. Co., Houston, Tex.....	28
Blackstone, Donald LeRoy, Jr., 2107 Elm St., Billings, Mont.....	37
Blackwelder, Eliot, Box N, Stanford University, Calif.....	19
Blackwell, William George, Dept. of Minerals, 111 Civil Court Bldg., New Orleans, La.....	39
Blair, Robert William, 551 Marion St., Denver, Colo.....	38
Blanchard, Frank N., Jr., Skelly Oil Co., Box 1822, Pampa, Tex.....	37
Blanchard, J. B., independent, 1128 Commerce Bldg., Houston, Tex.....	31
Blanchard, Stanley W., Standard Oil Co. of Texas, Petroleum Bldg., Houston, Tex.....	39
Blank, Horace Richard, Soil Conservation Service, Box 26, Waco, Tex.....	38
Blanpied, B. W., Gulf Refg. Co., Drawer 1731, Shreveport, La.....	23
Blau, Ludwig Wilhelm, Humble Oil & Refg. Co., Houston, Tex.....	30
Bleakley, Alfred Bishop, 1203 S. Utica, Tulsa, Okla.....	39
Bleecker, Edward S., 1615 Whitehall Bldg., 17 Battery Pl., New York, N. Y.....	21
Bleyberg, Arnold, Fohs Oil Co., 1340 Esperson Bldg., Houston, Tex.....	40
Blixt, John Elmer, The Texas Co., Box 405, Shelby, Mont.....	40
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Bloesch, Edward, consulting, 1410 Philtower Bldg., Tulsa, Okla.....	17
Blouin, Cecil Francis, Navarro Oil Co., Alice, Tex.....	39
Bocock, Oscar Lafayette, The Texas Co., Box 2332, Houston, Tex.....	38
Bode, Francis Dashwood, California Inst. of Technology, Pasadena, Calif.....	38
Bodkin, Hillard Winton, Superior Oil Co., 1004 Citizens Natl. Bank Bldg., Evansville, Ind.....	39
Boehms, Eugene Field, Forest Dev. Corp., 1220 Milam Bldg., San Antonio, Tex.....	31
Bohart, Philip H., Gulf Oil Corp., Box 661, Tulsa, Okla.....	23
Boling, Kenneth George, 1908 S. A St., Elwood, Ind.....	38
Bolinger, John Wiley, Humble Oil & Refg. Co., 202 Humble Bldg., Houston, Tex.....	38
Bolyard, Garrett L., Box 189, Houma, La.....	27
Bonar, Robert Emerson, Box 532, Denton, Tex.....	40
Bong, Carl P., Phillips Petr. Co., Corpus Christi, Tex.....	27
Boone, Dan Eugene, Halliburton Oil Well Cementing Co., Duncan, Okla.....	35
Boos, C. Maynard, 2818 Wisconsin Ave., Washington, D. C.....	26
Boos, Edward J., consulting, Breidenstein Bldg., Mt. Pleasant, Mich.....	27
Booth, Robert T., Standard Oil Co. of Texas, Petroleum Bldg., Houston, Tex.....	34
Booth, William Norfolk, 459 High Dr., Laguna Beach, Calif.....	38
Boots, Paul Heath, Gulf Research & Dev. Co., Box 2038, Pittsburgh, Pa.....	35
Borax, Eugene, Cadet B. T. C. No. 1, Boca Raton Club, Boca Raton Field, Fla.....	41
Borden, Joseph L., Pure Oil Co., Box 271, Tulsa, Okla.....	27
Borden, S. P., 517 City Bank Bldg., Shreveport, La.....	24
Boreing, Myriel James, Bird & Boreing, 711 Union Natl. Bank Bldg., Wichita, Kan.....	40
Borger, Harvey D., Standard Oil Co., Caripito, Venezuela, S. A.....	38

Born, Howard Raymond, Harrison Oil Co., 2105 Gulf Bldg., Houston Tex.,	39
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Boss, Reuel Lee, Gulf Oil Corp., Box 1667, Hobbs, N. Mex.	42
Bossard, Leon, New Zealand Petr. Co., 382 Devon St., W., New Plymouth, N. Z.	29
Bostick, Francis Xavier, 1947 Danville, Houston, Tex.	42
Bostick, J. Wallace, 4648 Waneta Dr., Dallas, Tex.	19
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Bowen, Gilbert Todd, 1705 Monte Vista Dr., Whittier, Calif.	38
Bowen, James P., Panhandle Refg. Co., Wichita Falls, Tex.	18
Bower, John O., Texas Petr. Co., Apt. Postal 877, Bogota, Colombia, S. A.	29
Bower, Thomas Henry, Trinidad Leaseholds, Ltd., Forest Reserve, Fyzabad, Trinidad, B.W.I.	42
Bowes, Glenn H., Continental Oil Co., 601 W. Fifth, Los Angeles, Calif.	24
Bowler, James William, Colombian Petr. Co., Apt. 100, Cucuta, Colombia, S. A.	39
Bowles, Edgar Oliver, The Republic Mining & Manufacturing Co., 230 Park Ave., New York, N. Y.	40
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Bowles, Thomas K., The Ohio Oil Co., Box 193, Bakersfield, Calif.	37
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Bowsher, Arthur Leroy, Box 308, Skellytown, Tex.	42
Boyd, Harold E., Panhandle Pipe Line Co., East Lansing, Mich.	17
Boyd, Lewis Henry, Brown Geophysical Co., 313 Professional Bldg., Bakersfield, Calif.	41
Boyd, W. Baxter, Continental Oil Co., Ponca City, Okla.	29
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Boylan, Ebert E., Caracas Petr. S. A., Apt. 89, Caracas, Venezuela, S. A.	19
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Boyles, James M., 3512 Travis St., Houston, Tex.	31
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Braccacini, Osvaldo I., Dto. Exploraciones, Y.P.F., Avda. R. S. Pena 777, Buenos Aires, Argentina S. A.	40
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Bradish, Ford, independent, 2005 Fort Worth Natl. Bank Bldg., Fort Worth, Tex.	19
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Braendlin, Emil, Speiserstrasse 89, Basle, Switzerland.	32
Brainerd, Arthur E., Continental Oil Co., Denver, Colo.	22
Bramkamp, Richard Allen, California Standard Arabian Oil Co., Bahrain Island, Persian Gulf.	40
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Branson, Edwin Robert, Carter Oil Co., Box 568, Mattoon, Ill.	38
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Breed, Edgar R., Jr., U. S. S. Chevalier, c/o Postmaster, New York, N. Y.	39

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Brewer, Charles, Jr., Godfrey L. Cabot, Inc., Box 1473, Charleston, W. Va.	27
Brewer, Ralph Roche, Jr., Stanolind Oil & Gas Co., Box 152, Oberlin, Kan.	42
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Broussard, Marion Ursin, Superior Oil Co., Houston, Tex.	43
Brouwer, Luitzen Egbertus Jan, Bataafsche Petr. Mij., Hoofdvertegenwoordiging, Batavia, N. E. I.	38
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Bunte, Arnold S., Vickers Petr. Co., Wichita, Kan.	26
Burbridge, Charles Edmunds, Jr., c/o Cia Minera de Penoles, S. A., Apt. 686, Mexico, D. F., Mex.	34
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Bush, Robert Ewell, Btry, C, 31 Bn. F.A.R.T.C., Fort Sill, Okla.	41
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Byram, John Perkins, Sandy Ridge Oil Co., 609 West Texas Utilities Bldg., Abilene, Tex.....	'38
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Callahan, Drury V., c/o Westheimer & Daube, Ardmore, Okla.....	'26
Calohan, William F., 2044 Addison, Houston, Tex.....	'31
Calvert, Warren Lytle, Ohio Fuel Supply Co., Fairfield, Ill.....	'39
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Camp, Richard W., Consolidated Gas Utilities Corp., 1004 Braniff Bldg., Oklahoma City, Okla.....	'30
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Canfield, Charles Reiter, Stanolind Oil & Gas Co., Midland, Tex.....	'35
Cannan, Morris, Midstates Oil Corp., Alice, Tex.....	'41
Cannon, Joe, Cannon & Cannon, 809 McBurnett Bldg., San Angelo, Tex.....	'28
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Carter, Devere V., Magnolia Petr. Co., Box 900, Dallas, Tex.....	'28
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Cassel, Chester, El Paso Hotel, Monterrey, N. L., Mex.....	'30
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Castel, Sanford H., Landreth Prod. Corp., Box 2077, Fort Worth, Tex.....	'30
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Chambers, Robert J., Co. H, 385th Inf., 76th Div., Fort George G. Meade, Md.	38
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MEMBERS

339

Devin, Fred A., Pure Oil Co., Box 271, Tulsa, Okla.	36
DeWolf, Frank W., Dept. of Geol. Univ. of Illinois, Urbana, Ill.	20
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Drake, Robert Tucker, The Texas Co., Box 600, Wichita Falls, Tex.	41
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Drindak, Joseph Thomas, Union Prod. Co., Box 758, Laredo, Tex.	40

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Dryden, Lincoln, Bryn Mawr College, Bryn Mawr, Pa.	42
Duce, James Terry, Petroleum Administration for War, New Interior Bldg., Washington, D. C.	20
Ducloux, Abel Herrero, Dep. de Exploracion, Y.P.F., Avda. R. Saenz Pena 777, Buenos Aires, Argentina, S. A.	41
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Dudley, Raymond W., Pure Oil Co., Box 2107, Fort Worth, Tex.	42
Dumbros, Nicholas George, 3111 W. Twentieth St., N., Arlington, Va.	42
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Dunbar, Robert O., Phillips Petr. Co., Bartlesville, Okla.	42
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Dunlap, John Crawford, c/o J. K. Bailey, Old Post Office Bldg., Chattanooga, Tenn.	40
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Dunn, David Arthur, Box 202, Tech. Station, Lubbock, Tex.	40
Durgan, Herbert Leonard, Bry. C, 31st Bn., 6th Reg., F. A. Repl. Tng. Center, Fort Sill, Okla.	37
Durham, Charles Albert, International Petr. Co., Ltd., Guayaquil, Ecuador, S. A.	39
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Durham, John Wyatt, Tropical Oil Co., Barranquilla, Colombia, S. A.	39
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Earl, Glenn M., 1043 Princeton, St., Santa Monica, Calif.	37
Earl, Will F., The Ohio Oil Co., Box 266, Falls City, Neb.	25
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Eberhardt, Adolph T., Shell Oil Co., Inc., Box 426, Evansville, Ind.	42
Eberle, Robert Francis, Superior Oil Co., 1004 Citizens Natl. Bank Bldg., Evansville, Ind.	40
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Eckart, Robert R., Jr., Shell Oil Co., Inc., Dallas, Tex.	41
Eckert, Frank E., Hanley & Bird, Bradford, Pa.	21
Eckhardt, E. A., Gulf Research & Dev. Co., Box 2038, Pittsburgh, Pa.	30
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Edson, Fanny Carter, Box 232, Rome, Ill.	22
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Edwards, Hall, Superior Oil Co., Evansville, Ind.	28
Edwards, Harold S., 612 S. Grand, Lyons, Kan.	42
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Ekholm, Victor E., Yacimientos Petroliferos Fiscales Bolivianos, La Paz, Bolivia, S. A.	28
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Elliott, John E., Atlanta Chemical Warfare Procurement Dist., Atlanta, Ga.	19
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Ellis, John Reese, c/o J. R. Ellis, Helena Agency, R. F. C., Helena, Mont.	42
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Fisher, Theodore Glen, 400 S. Cedar, Newkirk, Okla.	42
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Fitzgerald, Thomas J., Richfield Oil Corp., 560 Haberfelde Bldg., Bakersfield, Calif.	29

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Gerdes, Carl Herman, Socony-Vacuum Oil Co., C. A., Apt. 246, Caracas, Venezuela, S. A.....	39
Germany, Eugene Ben, 86½ Highland Park Village, Dallas, Tex.....	26
Germond, Kenneth Work, Shasta Oil Co., Box 711, Midland, Tex.....	42
Gester, George C., Standard Oil Co. of Calif., 1129 Standard Oil Bldg., San Francisco, Calif.....	20
Gester, Stephen H., Standard Oil Co. of Calif., 1128 Standard Oil Bldg., San Francisco, Calif.....	21
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Getzendaner, Frank M., Uvalde, Tex.....	21
Geyer, Robert Lloyd, Box 865, Olney, Tex.....	39
Gibbs, James F., Panhandle Refg. Co., Wichita Falls, Tex.....	27
Gibson, Donald Thomas, 2008 Twenty-sixth St., Lubbock, Tex.....	38
Gibson, George Drew, Box 835, Norman, Okla.....	37
Gibson, Howard A., 710 W. Twenty-four & One-half St., Austin, Tex.....	42
Giddings, Harvard, The Texas Co., Box 1270, Midland, Tex.....	26
Gierhart, Guy B., Humble Oil & Refg. Co., Box 1271, Corpus Christi, Tex.....	28
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Gilbert, Thomas Harold, Valley Osage Oil Co., 623 Mayo Bldg., Tulsa, Okla.....	42
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Gill, Joseph Powers, Sinclair Prairie Oil Co., Ardmore, Okla.....	38
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Goldschmid, Karl Theodor, Shell Co. of Ecuador, Apt. 340, Quito, Ecuador, S. A.....	41
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Hamner, Francis Merrick, Douglas Aircraft Co., Tulsa, Okla.	42

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Hill, John Junior, Baroid Sales Div., National Lead Co., Midland, Tex.	42
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Hinds, Henry, Greenwich Towers, Greenwich, Conn.	19
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Hlauschek, Hans, Romano Americana, Teleajen Works, Ploesti, Roumania.	30
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Hodder, Roland Frederick, Lone Star Steel Corp., Mt. Pleasant, Tex.	40
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MEMBERS

379

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Whittier, William H., Box 1166, Salt Lake City, Utah	24
Whittinghill, Frank Thomas, Jr., Floral Apts., Robinson, Ill.	39
Whitwell, E. V., Oliphant Oil Corp., Commercial Bank Bldg., Shreveport, La.	19
Whortan, Raymond A., consulting, c/o Lerke & Whortan, 423 Union Natl. Bank Bldg., Wichita, Kan.	35
Whorton, Chester D., Box 311, Coudersport, Pa.	29
Wiedenmayer, Carl, Societa Petrolifera Italiana, Fornovo-Taro, Parma, Italy	26
Wiegand, Frederick William, 1206 Magnolia St., Lockhart, Tex.	36
Wilbert, Louis Joseph, Jr., 406 Church St., Plaquemine, La.	40
Wilcox, Fred H., Magnolia Petr. Co., Box 633, Midland, Tex.	29
Wilcox, Stanley William, Seismograph Service Corp., 709 Kennedy Bldg., Tulsa, Okla.	40
Wilder, Newell M., 155 Hamilton Park, Lexington, Ky.	38
Wilhelm, Arthur K., 704 Empire Masonic Bldg., Bartlesville, Okla.	28
Wilhelm, Oscar G., Shell Oil Co., Inc., Box 2090, Houston, Tex.	41
Williams, Carroll L., Humble Oil & Refg. Co., Box 1331, Kingsville, Tex.	37
Williams, Charles Coburn, National Geophysical Co., 1002 Tower Petroleum Bldg., Dallas, Tex.	40
Williams, Francis S., consulting, 423 S. Maple, McPherson, Kan.	24
Williams, George C., consulting, 1843 W. Forty-seventh St., Los Angeles, Calif.	27
Williams, Herbert E., 533 Oil & Gas Bldg., Houston, Tex.	26
Williams, J. Stewart, Dept. of Geol., Utah State Agricultural College, Logan, Utah	37
Williams, John Raynesford, The Texas Co., Box 1737, Shreveport, La.	37
Williams, Lou, Pure Oil Co., Rm. 2308, 35 E. Wacker Dr., Chicago, Ill.	41
Williams, Meryl Dedrick, University Lands, Box 1663, Midland, Tex.	42
Williams, Philip Anthony, Carter Oil Co., Box 150, Magnolia, Ark.	41
Williams, Robert Neil, Jr., Honolulu Oil Corp., 10 Kern Co. Land Bldg., Bakersfield, Calif.	38
Williams, Thomas B., consulting, 3406 Sixth St., W., Calgary, Alta., Canada	30
Williams, William Alfred, Box 265, Capitola, Calif.	19
Williamson, Harry, Arkansas Fuel Oil Co., 1452 Canal Bldg., New Orleans, La.	37
Williamson, Thomas F., Victoria Cottage, Pittenweem Fife, Scotland	32
Willis, Clifford L., U. S. Naval Eng. Tng. School, 64 Sage Hall, Cornell Univ., Ithaca, N. Y.	40
Willis, Cornelius G., 1135 Subway Terminal Bldg., 417 S. Hill St., Los Angeles, Calif.	25
Willis, Robin, Hildon Oil Co., 1135 Subway Terminal Bldg., Los Angeles, Calif.	27
Willis, S. Morse, Carter Oil Co., Box 801, Tulsa, Okla.	24
Williston, Samuel H., 909 Studio Bldg., Portland, Ore.	24
Wills, Neil H., consulting, Box 520, Carlsbad, N. Mex.	34
Willson, Kenneth M., 705 Union Bank Bldg., Wichita, Kan.	29
Wilshire, L. M., Skelly Oil Co., Box 1650, Tulsa, Okla.	23
Wilson, Arthur Noble, 936 Woodland Ave., Houston, Tex.	40
Wilson, Cedric Clarke, Trinidad Petr. Dev. Co., Ltd., Palo Seco, Trinidad, B. W. I.	40
Wilson, Charles William, Jr., Vanderbilt Univ., Nashville, Tenn.	38
Wilson, Edward B., Sun Oil Co., Tyler, Tex.	22
Wilson, Ernest Bradley, Hogg Oil Co., Great Southern Bldg., Houston, Tex.	41
Wilson, Eugene England, Geotechnical Corp., 1702 Tower Petroleum Bldg., Dallas, Tex.	40
Wilson, Forest Wayne, American Republic Corp., Petroleum Bldg., Houston, Tex.	40
Wilson, Homer M., consulting, Box 250, Marathon, Tex.	27
Wilson, Ivan Franklin, U. S. Geol. Survey, Berkeley, Calif.	41
Wilson, James Ernest, Jr., Box 87, Rockdale, Tex.	40
Wilson, Joe G., Texas Petr. Co., Apt. 877, Bogota, Colombia, S. A.	31
Wilson, John H., 2015 Fort Worth Natl. Bank Bldg., Fort Worth, Tex.	21
Wilson, Joseph M., 6235 Richmond Ave., Dallas, Tex.	22
Wilson, Malcolm E., General American Oil Co., Dallas, Tex.	20
Wilson, Richard M., The Ohio Oil Co., Box 1129, Shreveport, La.	38
Wilson, Thomas C., Venezuelan Atlantic Refg. Co., Apt. 968, Caracas, Venezuela, S. A.	30
Wilson, Walter B., Gulf Oil Corp., Box 661, Tulsa, Okla.	21
Wimbish, Forrest E., Magnolia Petr. Co., Box 1882, Wichita, Kan.	28
Wines, Donald Bradford, Midstates Oil Corp., Tulsa, Okla.	29
Winfrey, Donald B., Petty Geophysical Eng. Co., Box 2061, San Antonio, Tex.	31
Winham, W. P., Standard Oil Co. of Calif., Box 1200, Bakersfield, Calif.	28
Winkler, Bruno Oscar, Rm. 1700, 26 Broadway, New York, N. Y.	31
Winkler, Hans, 104 W. Thirty-second St., Austin, Tex.	31
Winkler, Virgil Dean, Geol. Laboratory, Standard Oil Co. of Venezuela, Caripito, Venezuela, S. A.	40

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Wiringa, Leon Otis, Armed Guard Center (Pacific), Treasure Island, San Francisco, Calif.	37
Wise, Henry Francis, 108 E. Miner St., Stockton, Calif.	42
Wise, James Sharples, Wise Drilling Co., Okmulgee, Okla.	42
Wissler, Stanley G., Union Oil Co. of Calif., Box 511, Compton, Calif.	27
Witherspoon, Edgar, 3523 San Fernando, San Antonio, Tex.	40
Wofford, Henry Rollins, Jr., 234 W. Mistletoe Ave., San Antonio, Tex.	35
Wold, John Schiller, U.S.N.R., Cmdr. Service for Pacific Fleet, c/o Postmaster, San Francisco, Calif.	41
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Wolverton, Harold A., 2223 Brown, Wichita Falls, Tex.	41
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Wood, J. Pendleton, 341 Marion St., Denver, Colo.	27
Wood, Robert H., Broswood Oil Co., 430 Beacon Bldg., Tulsa, Okla.	20
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Woodford, Alfred O., Pomona College, Claremont, Calif.	24
Woods, E. Hazen, 2003 W. Brunson, Midland, Tex.	25
Woods, Raymond Douglas, c/o Mrs. C. C. Woods, 216 Beech St., Helena, Ark.	35
Woods, Sam H., Sun Oil Co., Box 1348, Tulsa, Okla.	25
Woodward, Albert Fletcher, 3928 Stockbridge, Los Angeles, Calif.	38
Woodward, George E., Jr., 2112 N. W. Twenty-fifth St., Oklahoma City, Okla.	29
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Woolley, Glen C., Transwestern Oil Co., Wichita, Kan.	28
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Wrather, William Embry, Metals & Minerals Div., Board of Econ. Warfare, Washington, D. C.	17
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Wright, Harry F., 304 Philtower Bldg., Tulsa, Okla.	19
Wright, Hugh, Texas Gulf Sulphur Co., 1275 Subway Terminal Bldg., Los Angeles, Calif.	30
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Wright, Thomas Goodman, Stanolind Oil & Gas Co., Box 1099, Shawnee, Okla.	40
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Wynne, Hal C., 110 E. Vinita St., Sulphur, Okla.	36
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Young, Jackson S., 245 Preston, Shreveport, La.	28
Young, Raymond Owen, Trinidad Leaseholds, Ltd., Forest Reserve, Trinidad, B. W. I.	42
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Young, Wilber H., Jr., Empire Gas & Fuel Co., Wellsville, N. Y.	35
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Zaba, Joseph, Rio Bravo Oil Co., Houston, Tex.	33
Zadik, Jacob William, Baker Oil Tools, Inc., Box 312, Olney, Ill.	39
Zaikowsky, Michael Wladimir, The Texas Petr. Co., Apt. 267, Caracas, Venezuela, S. A.	43
Zapp, Alfred D., U. S. Geol. Survey, Montezuma, Ga.	42
Zavoico, Basil B., Chase Natl. Bank, 18 Pine St., New York, N. Y.	25
Ziebold, William O., Spartan Gas Co., Box 766, Charleston, W. Va.	29
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Zimmerman, James Z., consulting, Delmont, Pa.	22
Zinke, Ernest Clarence, 1715 Ave. N., Galveston, Tex.	39
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Zorichak, Joseph J., Petroleum Administration for War, Denver, Colo.	24
Zuloaga, Guillermo, Standard Oil Co. of Venezuela, Caracas, Venezuela, S. A.	37
Zunino, Juan Jose, Servicio de Exploracion de Y. P. F., Vespucio, Provincia de Salta, Argentina, S. A.	42

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Anderson, Harold V.
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Anisgard, Harry William
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MAXWELL FIELD
Esunas, Bernard Joseph
MOBILE—Hudson, Joe Bailey
Murchison, Eugene A.
MONTGOMERY—Jones, Walter B.
SVLACAUGA—Sprongling, Kurt
UNIVERSITY
Andrews, Thomas Gayle
Richards, Edward Franklin
Toulmin, Lyman, Jr.

ARIZONA

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PRESCOTT—Bacon, Charles S., Jr.
SCOTTSDALE
Jones, Edward L., Jr.

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CAMDEN
Saubert, Robert William
EL DORADO
Dennis, Wilbert Chalmers
Dobie, Walter L.
Gaffney, John Edward
Kirby, Louis C.
Klinger, Edgar D.
Montgomery, Don D.
Rauch, Wayne C.
Wynn, Albert

FAYETTEVILLE—Giles, Albert W.
FOREMAN—Kerr, John B.
HELENA

Woods, Raymond Douglas
LITTLE ROCK
Anderson, Richard Jasper
Branner, George C.
Hardy, William McCombs
Malamphy, Mark C.

MAGNOLIA

Copeland, Richard G.
Maddox, Gerald C.
Vaughn, Grady Henry, Jr.
Williams, Philip Anthony
ROGERS—Mohler, Charles Edwin

CALIFORNIA

ALHAMBRA
Jamison, Paul Hugus, Jr.
Stone, Richard O'Neill

ALTADENA

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Curran, John F.
Heald, Charles Leslie
Pemberton, J. R.
Van Amringe, Edwin Verne
Vander Leek, Lawrence
Wheaton, Rowland G.

ARCADIA—Chase, William Lynn
AVENAL—Klingaman, George L.

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Beck, R. Stanley
Benzley, James C.
Berryman, Raymond J.
Bowles, Thomas K.
Boyd, Lewis Henry
Bryan, Joseph Jefferson
Burger, Robert W.
Carlson, Stanley A.
Cortright, William D.

Darke, Roy E.
Deming, Joseph Horace
Dennis, Terence Edwin
Dorrance, James R.
Dyk, Robert
Eckis, Rollin
Ellsworth, Theodore Phelps
Ferguson, Glenn C.
Fitzgerald, Thomas J.
Forrest, Lesh C.
Hale, John Darrow
Hewitt, Robert Leigh
Hill, Mason Lowell
Hobson, Henry David
Hornkohl, Frank
Howard, Paul Julian
Huey, Arthur Sidney
Ittner, Frank Edward
Junger, Arne

Kelley, Howard Allen
Kilkenny, John Edward
Kimble, James C.
King, Victor H.
Kistler, Phillip Sherman
Klempell, William D.
Knight, Jack William
Knoose, William Stanley
Krammes, Kenneth F.
LeConte, Joseph
Ledingham, Glen Wallace
Lupton, Benjamin Charles
Martin, Lois T.
Mathews, John William
Matjasic, Wallace Lee
May, Art R.
May, John C.
McMasters, John Herbert
Mead, Roy Gibbons, Jr.
Miller, Guy E.
Montgomery, Curtis Hall
Newbill, Thomas Jefferson, Jr.
O'Flynn, James Baldwin
Paschall, Robert Henry
Payne, Max B.
Peterson, Arthur Frederick
Pickett, Ed S.
Reel, Cecil E.
Saunders, Lowell W.
Schmeckle, Walter C.
Scott, David Holcomb
Schoemaker, Richard Walter
Siegfus, Stanley S.
Snedden, Loring B.
Sorge, Barthold William
Stanton, W. Layton, Jr.
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Taylor, Dewitt E.
Thomas, Norman L.
Thoms, Harold Wayne
Thomsen, Harry L.
Trombla, Lynn Burdeaux
Wadsworth, Francis Lowry
Walker, William Lester
Warze, Archer Hurst
Weddle, Herman W.
Williams, Robert Neil, Jr.
Winham, W. P.

BELVEDERE—Hollister, Joseph S.
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BERKELEY—Anderson, Frank M.
Clark, Bruce L.
Hulin, Carlton D.
Lawson, Andrew C.
Loudereback, George D.
Moody, Graham B.
Smith, James Archibald
Uren, Lester C.
Wilson, Ivan Franklin

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Miller, Robert H.

Pellekaan, W. Van Holst
Smith, Merritt B.
Sullwold, Harold H., Jr.

BURLINGAME

Cross, Charles Mumaw
CAMP SAN LUIS OBISPO
Cooper, C. Harrison

CAPITOLA

Williams, William Alfred
CHICO—Craig, Eric K.
CLAREMONT

Crowell, John Chambers
Woodford, Alfred O.
CLEARWATER—Torkelsen, O. I.
COACHELLA—Burnett, Jerome B.
COALINGA—Ashauer, Hans F.

COMPTON

Bravinder, Kenneth Mason
Wissler, Stanley G.
CULVER CITY—Holman, W. H.
ENCINO—Corey, William Henry
FELLOWS—Phillips, Ross Marvin
FRESNO—Ferber, Herbert James
Moran, Robert Breck, Jr.

GLENDAL—Crandall, Roderic
Gillan, Silas L.
Herold, Stanley C.
Pyle, Howard C.

Van Couvring, Martin
Wright, Fay Linton

HOLLYWOOD

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Gardner, A. Maclay
Holland, Laurier F. S.
Lewis, Milton W.
Sheller, James Warner
Van Beveren, O. F.

INDIO—Mathes, Donald E.
Meyer, Ruskin H.

INGLEWOOD—Crosby, Arthur S.
JACKSON—Heyl, George Richard
KERNAN—Ballard, Gene

LA CANADA

Crandall, Richard R.
Kribbs, George R.

LAGUNA BEACH

Booth, William Norfolk
LA JOLLA—Revelle, Roger R. D.
LOMPOC—Uhrig, Leonard F.

LONG BEACH

Armstrong, Ursel Sidney
Campbell, Harry A.
Chase, James
Dudley, Paul H.
Giffin, Wilson C.
Henquet, Roger
Hill, Robert Cowdery
Natland, Manley Leonard
O'Keefe, John, Jr.
Park, Stafford
Poland, Joseph F.
Rothwell, William Thomas, Jr.
Sinnott, Allen
Smith, Lyle Wyman
Stewart, Sam
Taylor, Spence Tomlinson
Ten Eyck, Warren E.

LOS ANGELES

Allen, William Hammond
Anderson, Thomas C. I.
Atwill, E. R.
Badley, Elmer R.
Bailey, James P.
Ballantyne, Richard S., Jr.
Barlow, Victor
Barnes, Roy M.
Bartosh, Edmund J.
Bates, Charles Carpenter
Beal, Carl H.
Beal, Carlton

Berg, Ernest L.
Blodget, Ward B.
Bowes, Glenn H.
Bramlette, Milton N.
Briggs, Colver Richmond
Buddenhagen, H. J.
Bundy, Douglas
Burnham, Roderick D.
Burt, John G.
Chambers, Lawrence Shiner
Chappuis, Louis C.
Chids, Theodore Scott, Jr.
Clark, Harold Joseph
Clark, Robert W.
Clement, Paul F.

Clute, Walker S.
Cogen, William Maurice
Cole, John Gordon
Collom, Roy E.

Creasey, Saville Cyrus
Cross, Rodman Kay
Curcio, A. Arthur
Cutler, Willard W., Jr.

Davis, Elmer Fred
DeGoes, Louis Lellanne
de Kock, William G.
DeMaris, Elmer L.

Detrick, Dana Farrington
Dodge, John F.
Dresbach, C. L.

Driver, Herschel L.
Durrell, Cordell
Easton, Joseph Edmund

Edwards, Everett C.
Edwards, Merwin G.
English, Walter A.

Evans, Louis H.
Ferguson, R. N.
Foran, William T.

Ford, Waldo Emerson, Jr.
Fortine, Dwight H.
Gallier, E. Wayne

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Gardner, Chester M.
Garipey, Glen Bernard

Gentry, Albert William
Gilluly, James
Goddie, Harry Anthony

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Graham, David H.
Grant, U. S., IV

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Greene, Ray G.
Gregersen, Albert Ingstrup

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Hall, Elwin B.

Hamill, James M.
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Hazzard, John Charles

Hogan, Dana
Holston, Ashly Stanford
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Hoots, Harold W.
Hopper, Richard H.
Huber, John Norris

Isberg, John T.
Jensen, Joseph
Johnson, Clifton Wood

Johnson, Harry R.
Johnston, Elizabeth Jane
Kemmiter, Luis E.

Kerr, Richard C.
Kew, William S. W.
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King, Vernon L.
Kluth, Emil
Knowlton, Drexel Robert

Krueger, Max L.
Laiming, Boris

- Lange, Robert William
Lee, Harvey Willmontont
Lewis, Lloyd Alan
Loel, Wayne
Long, Carl T.
Loofbourow, John Stewart, Jr.
Macready, George A.
Maxon, John H.
McCloskey, Downs
McCullough, Edward H.
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Metzner, Loyde Henry
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Minshall, Francis Edward
Moran, Robert B.
Morgan, Frank A.
Myers, Desaix B.
Noble, Earl B.
Ogier, E. H.
Oliver, Graydon
Osborne, Clarence B.
Park, Noel Robertson
Parker, Frank S.
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Rousselot, Norman A.
Ruby, Glen M.
Ruth, John William
Salvatori, Henry
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Sheldon, Dean Howell
Sherman, Richard W.
Sickler, Jack M.
Simmons, Rouse
Smith, George J.
Smith, Hampton
Smith, Wayne M.
Soper, Edgar K.
Stacy, Dean M.
Stanley, Everett Rollin
Steiny, Homer J.
Stewart, Irvine E.
Stipek, Raymond J.
Stolz, Harry P.
Swayze, Ronald O.
Tappolet, Werner
Tarbet, Loyal Alexander
Ten Eyck, Richard
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Thornburgh, Hubert Robert
Tieje, Arthur J.
Triplett, Richard L.
Tuttle, Helen Fowler
Valentine, William W.
Vallat, Eugene H.
Vandenberg, Frederick E.
Vandiver, Vincent W.
Vedder, Dwight G.
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Wagner, Carrol M.
Waltman, W. D.
Waterfall, Louis N.
Watson, C. P.
Watson, Elizabeth Anne
Williams, George C.
Willis, Cornelius G.
Winterer, Edward V.
Wood, James T.
Woodward, Albert Fletcher
Wright, Hugh
Young, Claude T.
Young, Umberto
Ziegler, Frederick McClain
- LOS RANOS—Adams, Bradford C
LOS NIETOS
Sinclair, John Taylor, Jr.
- LYNWOOD—Pence, Richard H.
MANHATTAN BEACH
Melville, Albert George
MCKITTRICK
Dooley, Albert Bertram
Kleeman, Albert P.
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MERCED
Pearson, Raymond Elliott
OAKLAND—Crook, Theo H.
Enders, Dean W.
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Sears, David Hume
OJAI—Osborne, Lee S.
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OXNARD—Nichols, Norman M.
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Dorwart, George Martin
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Galeski, Robert Benjamin
Grobecker, Alan John
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Lewis, William Dabney
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PUENTE—Buttram, William A.
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REDWOOD CITY
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SACRAMENTO
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SALINAS
Thorup, Richard Russell
SAN BERNARDINO
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SAN DIEGO—Fackler, John Henry
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SAN FERNANDO
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Cranston, Lorin A.
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Dickinson, Bernard Neil
Gaylord, E. G.
Gester, George C.
Gester, Stephen H.
Green, Charles Frederic
Hanna, G. Dallas
- Hardy, Norman
Harriss, Trewhitt Fairman
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Hudson, Frank S.
Hulsewe, Gerard Jan
Jenkins, Olaf P.
Lebkicher, Roy
McGovney, Paul E.
Menken, Fred A.
Ming, Raymond E.
Nomland, J. O.
Pickrell, Daniel J.
Sohlberg, Rudolph Gust
Stalder, Walter
Stoner, R. C.
Thomas, John William
Turner, Johnathan Douglas
Wells, John C.
Wiringa, Leon Otis
Wold, John Schiller
SAN GABRIEL
Bernt, Daniel Martin, Jr.
O'Brien, Jerome Joseph
Simon, Louis Joseph, Jr.
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Birkhauser, Max
Chapin, Theodore
Johnson, Curtis H.
Merritt, Floyd C.
Richards, George L., Jr.
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D'Evelyn, Morton Naylor
Knox, George L.
SAN PEDRO
Farmer, Edward Clifton
Henny, Gerard
SANTA ANA—Steel, Robert J.
SANTA BARBARA
Bremner, Carl St. J.
SANTA FE SPRINGS
Sherborne, John Elliott
SANTA MARIA
Hughes, Aden Wayne
SANTA MONICA—Earl, Glenn M.
SNOW, Robert Dale
SANTA PAULA
Robertson, George Kenneth
SHAFTER
Redwine, Lowell Edwin
SONORA—Solari, Allison Jarvis
STANFORD UNIVERSITY
Blackwelder, Eliot
Hughes, Donald D.
NAUS, Arthur William
Schenck, Hubert G.
Tickell, Frederick G.
Waters, Aaron Clement
STOCKTON—Wise, Henry Francis
STUDIO CITY
MacDonald, Erwin H.
TAFT—Barbat, William F.
Cerkel, J. David, Jr.
Coenen, Edward J.
Doell, Edward C.
Ellison, Burton Roland
Porter, John Lewis
Travers, William J., Jr.
Turman, Arthur F.
Woodward, Walter Thomas
VENTURA
Dibblee, Thomas Wilson, Jr.
Hawk, William Chester
Hertel, Francis W.
Leach, Claude E.
Merrill, William Raymond
Stewart, R. E.
VISALIA—Neumann, Fred. R.
WASCO—McCarver, Holland C.
WHITTIER—Bemis, Harold C.
Bowen, Gilbert Todd
Kelly, Robert Bowen
Lynton, Edward D.
White, Robert Thompson
WILMINGTON—Day, James R.
- WINTERS—Reynolds, Sargent M.
WOODLAND—Barling, Robert
Kennett, William Eric
- COLORADO
BOULDER—Rohwer, Frank W.
Thompson, Warren O.
Woodbury, Homer Olwin
COLORADO SPRINGS
Aching, Walter J.
Beardsley, William R.
Christensen, Alton Carl
Corey, George Simpson
Lindsay, Sidney Afton
Mathias, Henry Edwin
Osborne, Harry W.
DENVER—Ames, Edward W.
Aurand, Harry A.
Blair, Robert William
Bosco, Francis Neal
Brainerd, Arthur E.
Carter, George R.
Christensen, H. E.
Colle, Jack Overton
Cullen, Albert William
Dobbin, Carroll E.
Erdmann, Charles E.
Fanshawe, John Richardson
Fulton, Louis J.
Goldsmith, Leo Jean
Harrison, John W.
Harrison, Thomas S.
Henderson, Charles W.
Hendrickson, Victor J.
Holloman, Roy
Kramer, William B.
Lavington, Charles S.
Lee, John Edward, Jr.
Manton, Clarence E.
McCabe, William Stokes
McCready, Harry Joseph, Jr.
McMillan, Robert
Mellen, William P.
Miller, David B.
Nelson, Walter S.
Rath, Charles M.
Rennie, Waldo E.
Robbins, Raymond Willis
Shaw, Everett S.
Shoenfelt, C. E.
Snyder, Raymond W.
Spratt, Robert Elmer
Stewart, Hugh A.
Volk, Russell H.
Walton, Karl L.
Walton, Paul Talmage
Weeks, Albarth W.
Wolters, Earl M.
Wood, J. Pendleton
Zorichak, Joseph J.
ESTES PARK—Heaton, R. L.
FORT COLLINS
Stommel, Harrison Edred
GLENWOOD SPRINGS
Ervin, Lynn Delbert
GOLDEN—Bozbag, Hamdi Ahmet
Heiland, Carl A.
Johnson, J. Harlan
LeRoy, Leslie Walter
Parker, Ben H.
Skeeters, Warren Ware
Stevens, Edward H.
Tripp, Russell Maurice
Van Tuyl, Francis M.
Waldschmidt, W. A.
Wantland, Dart
IDAHO SPRINGS
Conwell, Cleland Neeper
PUEBLO—Marshall, Jesse William
- CONNECTICUT
GREENWICH—Hinds, Henry
NEW HAVEN—Bateman, Alan M.
Crickmay, Geoffrey W.
Longwell, Chester R.

PORTLAND—Miller, John R.
STOKES—Lucke, John B.

DELAWARE

WILMINGTON
Budd, Montgomery Randolph
Gillon, Joseph L.

DISTRICT OF COLUMBIA

ANACOSTIA—Mayfield, Gid C.
FRIENDSHIP STATION
Straley, Harrison Wilson, III
WASHINGTON—Avery, C. Dwight
Baker, Arthur A.
Billings, Martin Hewett
Boos, C. Maynard
Cortes, Henry Cornelius, Jr.
Cox, Harris
Dane, Carle H.
Darton, N. H.
Dawson, Robert John
Dickerson, Roy E.
Dorr, John Van Nostrand, II
Drach, Gertrude M.
Duce, James Terry
Emmerich, Harry H.
Farrell, Agnes M.
Finch, Elmer H.
Gallie, John Francis
Gardner, Julia
Geis, Wilfrid H.
Grove, Brandon Hambright
Hard, Edward W.
Henbest, Lloyd G.
Hendricks, Thomas A.
Heroy, William B.
Hoffman, Malvin G.
Hough, Jack Luin
Imlay, Ralph Willard
King, Philip B.
Knechte, M. M.
Krumbein, William C.
Lang, W. B.
Lewis, J. Volney
Lott, Frederick S.
Loughlin, Gerald F.
Martin, George C.
McCammon, John Henry
McGhee, George C.
McWhirt, Burr
Mendenhall, Walter C.
Miller, J. Charles
Miser, Hugh D.
Morgan, Charles Gill
Needham, Claude E.
Otton, Edmond George, III
Page, Lincoln Ridler
Payne, Thomas Gibson
Pierce, William Gamewell
Putnam, William Clement
Reeside, John Bernard, Jr.
Richards, Ralph W.
Robie, Robert Hodges
Rodgers, John
Sayre, Albert Nelson
Sears, Julian D.
Shelton, John Sewall
Speed, Carleton D., Jr.
Stephenson, Lloyd W.
Sterrett, Douglas B.
Stipp, Thomas F.
Springfield, Victor Timothy
Taylor, Josiah
Traeger, Earl A.
Trask, Parker D.
Townsend, Rex M. F.
Ulrich, E. O.
Van Orstrand, C. E.
Vaughan, T. Wayland
Waring, Gerald A.
Wenger, Sherman Alexander
White, Paul Cubage
Wrather, William Embury

FLORIDA

ARCADIA—Monsour, Emil

AVON PARK

Tennis, Langdon Carlisle
BOCA RATON FIELD
Borax, Eugene
CAIRLEY
McCampbell, William Gibson, Jr.
COCONUT GROVE
Yarborough, Hunter, Jr.
EAU GALIE—James, Wright E.
EUSTIS—Kinser, James Hanford
HOLLYWOOD
Evans, Frank H., Jr.
JACKSONVILLE—Little, Sterling E.
LAKE WORTH—Fryou, Joe A.
MIAMI—Corning, Leavitt, Jr.
Parker, Gerald Gordon
Tompkins, J. D.
ST. AUGUSTINE
Ponton, Gerald M.
TALLAHASSEE—Gunter, Herman
Stubbs, Sidney Alton
TAMPA—Baysinger, Eugene M.
Campbell, Robert B.
TYNDALE FIELD
Stapp, Wilford Lee

GEORGIA

ATLANTA—Elliott, John E.
Girdler, Joseph Hayes
Pelt, Chester Robert
CAMP STEWART—Baxter, John C.
COLUMBUS
McClain, Forrest Milton
EMORY UNIVERSITY
Munyan, Arthur C.
FORT McPHERSON
Bachman, Ford Frederick
Goodrich, Paul K.
MONTEZUMA—Zapp, Alfred D.
SAVANNAH—Brown, Augustus B.

ILLINOIS

ATLANTA—Montjoy, Joseph Bode
BELLEVILLE
Buehner, John Hubert
BENTON—Hockman, James N.
BRIDGEPORT—Hengst, Jess H.
CARM—English, Robert M.
Turnbull, Wade William
Webb, John Hanor
CENTRALIA
Brown, Orman Pearson
Caylor, Garth William
Clark, Leslie M.
Drake, Cecil
Ellsworth, Elmer W.
Farlee, Richard Wilson
Frey, Alfred P.
Hager, Dorsey
Hand, Hiram Darby
Hardin, Clifford G.
Hinche, Norman Shreve
Jensen, Frederick T.
Koch, Heinrich, Louis
McGee, J. Rex
McNeal, Robert Paul
Mylus, L. A.
Rankin, Horace Ellis
Robinson, Ernest Guy
Simmons, Kenneth A.
CLAMPAC—Folk, Stewart
CHICAGO
Alshar, Freydon Azadi
Brinkerhoff, Ira A.
Cram, Ira H.
Cronels, Carey
Doan, Richard Lloyd
Gross, Henry Emmett
Hadley, Herbert David
Hamilton, Irving Boyd
Hoffman, Arnold D.
Stevens, Frank Vincent
Wadell, Hakon A.
Wasson, Theron
Wegemann, Carroll H.

Williams, Lou
Wood, Fred E.
CROSSVILLE
Latimer, Fred Hubert
ELDORADO
Melvin, Marlowe Douglas
ELIZABETHTOWN
Hardin, George C., Jr.
EVANSTON—Ball, John Rice
Dapples, Edward Charles
Gutru, Robert James
FAIRFIELD
Calvert, Warren Lytle
FLORA—Giles, Howard W.
HARRISBURG
Hunzicker, Ashley Andrew
HIGHLAND PARK
Newcombe, Robert J. B.
LAWRENCEVILLE
Moulton, Gail F.
MARSHALL
Bristol, Hubert Masters
Donnelly, Clarence William
Gram, Oscar Ehsen
Konkel, Philip M.
Kurtz, Robert G.
Sternberg, Charles William
MATTOON—Anderson, Carl B.
Anderson, Rudolph Faraday
Branson, Edwin Robert
Brown, Otto E.
Cartmell, William Martin
Chasey, Kenneth LeMay
Dana, P. L.
Farmer, Paul
Fuller, Melville Weston
Harris, Lloyd Addis
Hirsch, Jack
MacNeill, Donald J.
McCulloch, James Cole
McHugh, James W.
Morgan, Lindsey G.
Scott, Vernon C.
Simonton, Owen W.
Spaulding, Bernard B.
Staplin, Rex Weiland
Stratton, Everett Franklin
Walcher, Wayne E.
MT. CARMEL—Egan, Martin G.
Horton, Harold M.
MT. VERNON
Brehm, Clarence E.
Davies, Nathan C.
Ferebee, D. M.
Hruby, Milton
Keenan, James Edward
Moore, Fred Holmsley
Obering, Ernest A.
Rehn, Edgar Ernest
Sellin, Hilding A.
Smith, Julian W.
Straugan, George M.
Tuck, Louis Lester
Wall, Thomas E.
Whitney, Paul A.
NEWTON—Dana, Drexler
OLNEY—Cronin, K. Stewart
Fellows, Robert Arthur
Green, Darsie A.
LaPeire, George W.
Mitchell, James G.
Yunch, George Feick
Zadik, Jacob William
PRINCETON
Becker, Leroy Everett
ROBINSON
Diemer, Raymond Adams
Whittinghill, Frank Thomas, Jr.
ROCKFORD
Barrett, John Frederick
ROME—Edson, Fanny Carter
ROSCHE—Brecke, Ervin A.
Sutton, Arle Herbert
SALEM
Ditsworth, Glenn William
Kneale, William C.

Marvin, Gaurd Scott
SCOTTS FIELD
Melsheimer, Albert Harry
SPRINGFIELD
Raman, Norman Dean
Summers, Charles Henry
ELMO—Lewark, James Edward
Richards, Ben Howard, Jr.
URBANA—Bell, Alfred H.
Carter, Charles William
DeWolf, Frank W.
Easton, William Heyden
Gutschick, Raymond Charles
Hiller, Carl Frederic
Jones, Verner
Leighton, Morris M.
Pullen, Milton William, Jr.
Scott, Harold William
Tippie, Frank Emerson
Townley, End
Wanless, Harold R.
Weller, J. Marvin
Workman, Lewis Edwin
VANDALIA—Sklar, Maurice

INDIANA

ANDERSON—Brown, Ira Otho
BLOOMINGTON—Esarey, Ralph E.
Fender, Hollis Blair
Fidler, Marion Moore
Galloway, Jesse J.
Kralis, Dan F., Jr.
Spencer, Charles Grason
ELWOOD
Boling, Kenneth George
EVANSVILLE
Barbour, Richard Morton
Bodkin, Hillard Winton
Bybee, Halbert Homer
Cahill, Edgar D.
Clay, Withers
Cole, Edwin G.
Combs, Edward Jolley
Cooper, Russell Calvin
Eberhardt, Adolph T.
Eberle, Robert Francis
Edwards, Hall
Elder, Stanley G.
Falletti, Tony D.
Farrand, William Gardner
Forsyth, Roderick James
Georgesen, Niels Christian
Gow, Kenneth L.
Hicklin, Richard Stuart
Hoke, Charles Jacob
Hones, Charles W.
Hoover, W. Farrin
Hudson, Oscar McDonald
Kemp, Edward Rogers
Nowlan, Harry H.
Nuckolls, William Carlisle
Piggott, Guido M., Jr.
Potet, James Harold
Pye, Willard D.
Reeves, James E.
Sackett, H. F.
Snider, George W.
Stith, Sam Henry, Jr.
Sutton, Donald G.
Taylor, George Ernest
Wells, Samuel W.
Wesley, George Rutherford
Westmoreland, Earl
FARMERSBURG—Heap, George E.
FORT WAYNE
Parker, Norbert Allen
Somers, George Brooks
GREENCASTLE
Smith, Ernest Rice
INDIANAPOLIS
Cohen, George V.
Hagan, Wallace Woodrow
Hake, Benjamin F.
Ingham, W. I.
Keller, P. Hastings
Longmire, William R.

Mundorf, T. Dean
 Scooby, Ellis Hurlbut
MONTICELLO
 Baer, Daurice Frank
PRINCETON
 Mauck, Melvin Dwight
SOUTH BEND
 Smith, Knowles B.
VINCENNES—Sprowls, Harlan A.
CEDAR RAPIDS
 Vesely, Leon Robert
COIN
 Goodman, Herbert Maynard
DES MOINES—Lonsdale, John T.
FORT DODGE—Wasem, Richard
IOWA CITY
 Kummel, Bernhard, Jr.
 Miller, Arthur K.
 Tester, Allen C.
 Trowbridge, Arthur C.
MT. PLEASANT
 Smith, Marcus Ayres J.
MT. VERNON
 Bennett, Robert Turner

KANSAS

ABILENE—Verckler, Stewart P.
BARNARD—Tucker, Paul M.
BUCKLIN—Madden, Lloyd Willis
CHASE—Price, Arthur Sebert
COLUMBUS—Martin, V. Dale
CUNNINGHAM
 Lillibridge, Frederick S.
DODGE CITY—Todd, John David
EL DORADO
 Berry, George F., Jr.
FREDONIA—Stryker, William L.
GODDARD
 Decker, William Mansfield
GREAT BEND—Denman, C. E.
 Johnston, Robert L.
 Knight, L. Clark
 McCullough, Russell L.
 McDaniel, Fred
 Shannon, Sherril A.

HAYS

Messman, Roger Lawrence
HUGOTON—Cooper, James Blair
INDEPENDENCE

Studd, Charles W.
IOLA—Page, James H.
LAWRENCE—Brown, Silas C.

Clark, James Tate
 Jakosky, John Jay
 Jones, Ogden S.
 Laudon, Lowell R.
 Lee, Wallace
 Moore, Raymond C.
 Stephenson, Eugene A.
 Swineford, Ada

Thompson, Marcus Luther
LYONS—Edwards, Harold S.
 Taylor, M. Hall

MCPHERSON—Hurd, Clinton O.
 Williams, Francis S.

MDLAND—Putnam, George D.

OVERLIN—Brewer, Ralph R., Jr.

Morgan, Aubrey Austin

PITTSBURG

Abernathy, George Elmer

SEDAN—Disney, Orville A.

TOPEKA—Allen, Devere F.

Baldwin, Benjamin Franklin

Rogers, Andrew J.

WELLINGTON

Matthews, Charles L.

Matthews, Edwin Patterson

WICHITA—Abbott, Wayne Rosser

Agey, Charles Samuel

Ainsworth, David

Allen, Thomas H.

Allen, Donald M.

Barwick, John S.

Baughman, George W.

Baumeister, Dorothy

Bear, Melvern Fred

Beebe, B. W.
 Boring, Myriel James
 Bowser, William F.
 Bradley, Everett L.
 Brooks, Benton Snow, Jr.
 Brooks, Frank M.
 Bruce, George H.
 Bryant, Howard S.
 Buck, Loren I.
 Buehler, Karl Martin
 Bunte, Arnold S.
 Bucher, Seldon D.
 Carlson, Edwin N.
 Carmody, Robert Arthur
 Carpenter, E. Gail
 Cheyney, Alvin E.
 Clark, Robert Scarth
 Cole, Virgil B.
 Conselman, Frank B.
 Copass, Jack M.
 Cornell, Lee H.
 Costa, Delbert James
 Dahl, Arnold C.
 Daniels, James I.

Dunn, Burton Crawford

Edmiston, Elliott K.

Elledge, Emmett R.

Everett, Rizer

Ferguson, John Inger

Fisher, Frank Lynn, Jr.

Folger, Anthony

Fortier, Leo R.

Galley, John E.

Galloway, George Harold

Gardner, Jack Winston

Garlough, John L.

George, Robert Freeman

Given, Robert Jennings

Hall, Roy H.

Harper, Paul Ashton

Hay, Lawrence C.

Heathman, Jack Hastings

Heathman, Walter W.

Henson, Gurrie R.

Holl, Frederick G.

Holmes, S. W.

Howell, William F.

Imbt, William C.

Inkster, John W.

Isaacs, Elizabeth A.

Jager, Eric Howard

Kesler, L. W.

Koester, Edward A.

Kornfeld, Sam

Lamb, Ralph Charles

Larkin, John Jennings, Jr.

Larsh, Walter W.

Lee, Marvin

Low, Julian W.

McHugh, William Ernest

McMurtry, Wilbur Earl

McNeely, Robert B.

McNeil, Harold E.

Mettner, Francis Edwin

Meyer, Robert Frederick

Michaelson, Louis Henry

Moncrief, E. C.

Moody, Ray R.

Moore, Gilbert Parvin

Morgan, L. C.

Mull, J. A., Jr.

Oyster, Frank A.

Paddelford, Jack Teal

Peters, Theodore Clinton

Pelbrick, Eugene P.

Powers, Delmer L.

Pratt, Ernest S.

Quensberry, Alice Mildred

Redmon, Harold E.

Reid, Kenneth James

Reiserer, Victor Fletcher

Roberts, Richard Lee

Roberts, Thomas N.

Roop, Charles W.

Russell, Harry Jones, Jr.

Sammons, George B.

Schuldt, Walter Carl
 Selk, Erwin L.
 Smedley, Harold O.
 Smith, J. Peter
 Smith, Millard Wesley
 Speer, George Woodrow
 Stafford, Clare J.
 Stucky, Zenas E.
 Sullivan, Chris Rice
 Talbott, W. G.
 Turner, Joseph H.
 Ver Wiebe, Walter A.
 Vickery, Ward R.
 Waddell, Richard Kent
 Ward, Roland Van
 Webb, Rieman Shaw
 Whortan, Raymond A.
 Willson, Kenneth M.
 Wimbish, Forrest E.
 Winzler, Alvin Raymond
 Woodward, Harold Robinson
 Woolley, Glen C.

KENTUCKY

ASHLAND—Browning, Iley B.
 Hunter, Coleman D.
 Thomas, Ralph N.

BOWLING GREEN—Evans, Vincent
 Newton, William A.

ELIZABETHTOWN
 McClure, Perry S.

GLASGOW—Preston, John Basil

HENDERSON
 Morrill, Junius Houghes

LEXINGTON
 Branson, Carl Colton

Freeman, Louise Barton

Jones, Daniel J.

McFarlan, Arthur Crane

Miles, Phil Middleton

Wildner, Newell M.

LOUISVILLE
 Stouder, Ralph Eugene

OWENSBORO
 Barnes, Augustine Edward, Jr.

Brown, J. Albert

Damron, Wallace

Knipe, Ralph E.

Shiarella, Nicholas W.

PAINTSVILLE—Jenkins, Philip

LOUISIANA

ALEXANDRIA
 Kaplan, Lazard Harold

Richardson, Felix Dorman

BASTROP
 Stanley, Thomas Benjamin, Jr.

BATON ROUGE
 Ackley, Kenneth A.

Aycock, Lester Charles

Bell, Harry Wesley

DeBlieux, Charles

Dunbar, Clarence P.

Fisk, Harold N.

Gay, Andrew H.

Harang, Jack Francis

Hendy, William James, Jr.

Howe, Henry V.

Huner, John, Jr.

Jones, Paul Hastings

Lyons, Percy Marvin

Maier, John C.

Manning, Lloyd R.

Martin, James Littell, Jr.

Mayer, Maurice Joseph, Jr.

McGuirt, James H.

Mitchell, Mark William

Romans, William Alexander

Roy, Chalmers J.

Rukas, Justin Matthew

Russell, Richard Joel

Smith, Robert Hendee

Sprague, Robert D.

Tator, Benjamin Almon

Woodward, Truman Pendleton

Bourg—Rodgers, John Albert

BURAS—Eskrigge, Tatham R.
CAMP CLAIBORNE
 Mohler, Donald Phillips
CAMP LIVINGSTON
 Lester, John Lawrence
CROWLEY—Patton, Jacob L.
DE RIDDER
 Granberry, Raymond James
 Iles, George, Jr.
GRETNNA—Kipp, Earl Mathew
HOUMA—Bolyard, Garrett L.
 Broughton, Martin Napoleon
 Campbell, John Leslie Putnam
 Ronbeck, Arthur Charles
 Seashore, Paul T.

JEANERETTE
 Robichaux, Douglas B.

JENA
 McBee, William Dalton, Jr.

LAFAYETTE
 Bates, Fred Westerman

Beckman, Michael William

Bernard, Hugh Allen

Bingham, Dwight H.

Bornhauser, Max

Fry, Earl E.

LeRoy, Tom E.

Miller, Arthur Douglas

Mills, Coe S.

Pennel, Harry David

Sands, Charles Dudley

Wharton, Jay Bigelow, Jr.

LAKE CHARLES
 Canada, William Richards

Henning, John L.

Johnson, Holger Olin

Mahoney, John Francis

McGlasson, H. E.

Morrow, A. Lyndon

Roach, Cyril Bloomfield

Tygett, H. V.

Vincent, Mordelo L., Jr.

Watson, Robert N.

LAKE PROVIDENCE
 Houston, Sam H., Jr.

MONROE—Fergus, Preston

McAuliffe, Gilbert C.

NATCHITOCHEES
 Holland, Richard Marion, Jr.

Howard, Douglas Duke

NEW Iberia
 Calahan, Luther Weldon

Sparenberg, G. R.

NEW ORLEANS
 Arnold, Emmett L.

Atwater, Gordon I.

Babin, Logan Henry

Blackwell, William George

Bremer, Bernhard E.

Brown, Leonard Irving

Bybee, Robert William

Carey, J. Ben

Clark, George Howard

Clement, George M.

Copeland, Robert R., Jr.

Crandall, Kenneth H.

Davies, Herman F.

Denham, Richard Lane

Dobrick, Edward G.

Efinger, William Lloyd

Fahle, Paul Bartlett

Fox, James P.

Gaby, Edwin D.

Goerner, Fred Stephen

Goodwill, Donald, Jr.

Hadley, Wade H., Jr.

Hickey, Harold N.

Hoover, J. Wilkinson

Loeblich, Alfred Richard, Jr.

Loeblich, Helen Nina Tappan

Lund, Gage V.

McNab, James

Metts, Dean Francis

Moresi, Cyril K.

Nichols, Ernest Turnley

Nichols, Ivan K.

Partridge, John Frederick, Jr.
Payne, Willard M.
Petersen, Harluf C.
Petersen, Morton Qvistgaard
Richardson, H. T.
Samford, Finis Mack
Schall, Fred Muller, Jr.
Schneider, G. W.
Seedle, Charles William
Shepherd, George Frederick
Smith, Neal Johnstone
Steinmeyer, R. A.
Wall, Earle R.
White, Richard D.
Williamson, Harry

PLAQUEMINE

Barry, John O'Keefe
Wilbert, Louis Joseph, Jr.
RAYNE—McLendon, Dan Harvey
RUSTON—Laskey, G. E.

SHREVEPORT—Aimer, James D.

Alexander, Clyde Wayne
Barret, William Morris
Bartell, Laurence D.
Barton, Louis A.
Beck, Robert W.
Becker, Raymond C.
Blampied, B. W.
Borden, S. P.
Braunstein, Jules
Brockway, E. R.
Buchner, Harry M.
Caster, Ernil Leslie
Chapman, Richard Thomas
Cheesman, Beynon Sale
Clark, Chester C.
Cochran, Phil K.
Corbin, Milton Wallace
Cox, Herbert Mack
Cridler, Albert F.
Crow, Louis Milton
Day, Clarence O.
Eaves, Everett

Fischer, LeRoy Fred
Fischer, Victor Nathaniel
Flesh, David James
Freed, Richard
Goebel, Lawrence A.
Goldstein, August, Jr.
Grage, Victor P.
Green, George Gardiner
Grigsby, Garland O.
Grubbs, David M.
Hardin, Vern A.
Harlowe, Leslie S.
Hawley, Luther David
Hazzard, Roy T.
Hoffmeister, William S.
Holden, Frederick Thompson
Hutson, E. B.

Jackson, Alvin M.
Jones, John Percy
Kamb, Hugo R.
Kreidler, William Lynn
Lancaster, L. Kenneth
Loomis, Frederic Brewster, Jr.
Lytle, J. Edward
Magale, John F.
Marshall, Lester Ray
Marshall, Walter Hill
McCasland, Barney Clifton, Jr.
McFarland, L. R.
McKnight, C. R.
McLaren, Robert L.
McMorris, William Albert, Jr.
Meltzer, Lee Hillard
Mix, Sidney E.
Monsour, Edward

Monsour, Eli T.
Moody, Clarence L.
Moody, John Drummond
Orchard, Paul Joseph
Packard, Sidney A.
Parker, Lloyd S.
Philpott, Thomas Hughes
Pickleimer, Harold G.

Plaster, William M.
Purzer, Joseph
Rand, William Whitehill
Rank, Raymond A.
Robinson, Van Daniel
Safonov, Anatole
Schwartz, Channing Beryl
Shearer, Harold K.
Smith, Lloyd B.
Spears, Walter H.
Spofford, Howard N.
Spoonor, W. C.
Stewart, Charles A.
Stiller, Ernest A.
Sullivan, Albert Martin
Swain, Frederick Morrill
Thomas, George Dewey
Totten, Robert Briggs
Van Gilder, H. R.
Vernon, Benton R.
Wallace, William Edwin, Jr.
Walton, George Goodrich
Weeks, Warren B.
Weintz, Clement A.
Weltman, Louis H.
Whatley, James Moulton
Whitwell, E. V.
Williams, John Raynesford
Wilson, Richard M.
Young, Jackson S.

SULPHUR

Farley, William Richard
Kilian, Harry
May, George Nolan
Moore, James A.

THIBODAUX

Agee, Flint Humphrey
Cook, Everett Earl
WAKEFIELD
Kilbourne, Lewis Perkins
WINNFIELD
Wade, Rolla Theadore

MAINE

SKOWHEGAN—Smith, George Otis

MARYLAND

BALTIMORE—Dorsey, Geo. Edwin
Nance, Jack B.
Singewald, Joseph T., Jr.
BETHESDA—Huntley, Louis Guy
CHEVY CHASE
Crowell, John Head
FORT GEORGE C. MEADE
Chambers, Robert J.
SILVER SPRINGS
Strothmann, Frederick Henry

MASSACHUSETTS

BOSTON—Bediz, Pertev I.
La Croix, Morris F.
CAMBRIDGE—Lane, Alfred C.
Mather, Kirtley F.
McIntyre, George Taylor
Oliphant, Charles W.
Whitehead, W. L.
Yenne, Keith Austin
EVERETT—Haskell, Norman A.
LINCOLN—Beers, Roland F.
NEEDHAM HEIGHTS
Adams, Clyde B.

NORTHAMPTON
Shaub, Benjamin Martin
QUINCY—Gisburne, John Robert
SPRINGFIELD—Robinson, Joseph

MICHIGAN

ALLEGAN
Nicola, Oliver Peter, Jr.
ANN ARBOR—Belknap, Ralph L.
Kellum, Lewis B.
Landes, Kenneth Knight
Lovering, T. S.
CASSOPOLIS
Bishop, Margaret Stearns

CLARE—Fugate, Ross James
GRAND RAPIDS

Hunt, Raymond S.
Smith, Robert Harlowe
Whitney, Paul B.
Wyckoff, J. W.

HANCOCK—Waters, Joyce Irene

JACKSON—Gentry, Howard L.

LANSING—Boyd, Harold E.

Buttermore, Paul M.

de Cousseur, Kurt H.

Grant, Rex Potter

Martin, Helen M.

Smith, Richard A.

Wynn, Warren H.

LUDINGTON—James, Jay R.

MT. PLEASANT—Boos, Edward J.

Brown, William F.

Clark, William A.

Jenkins, Page T.

Lamar, Lee C.

Moses, Carl Edward

Schulz, William M.

Sleight, Glenn C.

Stewart, Norman Robert

Thomas, William A.

SAGINAW—Addison, Carl C.

Baltrusaitis, Edward Joseph

Becker, Ralph E.

Clark, Charles Koogle

Gulde, Andros

Kirkham, Virgil R. D.

Maebius, Jed B.

Osgood, Manley, Jr.

MINNESOTA**CAMP SAVAGE**

Taber, Edward Carroll, Jr.

DULUTH—Arper, William B., Jr.

MADEIRA—Anderson, Tom A.

MINNEAPOLIS

Donovan, Percy W.

Emmons, William H.

Miller, Lloyd Eugene

Stauffer, Clinton R.

MISSISSIPPI

CANTON—Howard, George Carl

HATTIESBURG

Munroe, Donald J.

HAZLEBURST—Zimmerman, Sam

JACKSON—Cram, Edward C.

Dennis, Lyman Clark

Dockerv, Willard Lyle

Grubb, Carl F.

Harrell, David C.

Harris, R. Merrill

Huff, Jack Newton

Hughes, Urban B.

Jeffreys, Geoffrey

Kennedy, John B.

McGlothlin, Tom

Mellen, Frederic Francis

Michael, James F.

Morgan, Cecil L.

Murray, Grover, Jr.

Reese, Donald M.

Rouse, John Thomas

Spooner, Knight Keith

Stephenson, Cuthbert D.

Storey, Joseph Burnette

Talley, Gilbert Arthur

Toler, Henry N.

Womack, Brame

NATCHEZ—Reed, Paul Carty

OXFORD—Monroe, Watson H.

TUPALO—Jenkins, George Marvin

UNIVERSITY

Brown, Glen Francis

Morse, William C.

VICKSBURG

Chawner, William Donald

Meagher, David Pope

Payne, C. Winthrop

YAZOO CITY

McCoy, Joseph Hanford

MISSOURI

CLAYTON—Briscoe, Glenn O.

COLUMBIA—Branson, E. B.

Burling, Lancaster D.

Curtis, Lawrence Willford

Mehl, M. G.

FORT LEONARD WOOD

Prescott, Gordon Walter

HIGGINSVILLE

Leonard, Clarence Ziegler

INDEPENDENCE—Davis, Gene O.

JOPLIN—Fowler, George M.

KANSAS CITY

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Austin, Robert Burton

Bartle, Glenn G.

Smith, Rufus McBride

MAYSVILLE

Quigley, Claude Merle, Jr.

MOUNTAIN VIEW

Ferrell, Max Everett

PLATTE CITY

Abbey, Gerald Ellsworth

ROLLA—Buehler, H. A.

Claire, Joseph Robinson

Dake, Laurence Falkenstein

Ellison, Samuel P., Jr.

Greene, Frank C.

McQueen, Henry S.

Mullenburg, Garrett A.

Noble, Gilbert W.

St. Louis—Bakke, W. E.

Rife, Byron

Stearn, Noel H.

Wheeler, H. A.

WEBSTER GROVES

Buchner, Carl F.

MONTANA

BILLINGS—Berg, Karl A. E.

Blackstone, Donald LeRoy, Jr.

McCoy, Alexander Watts, III

Neiler, William Dixon

Seager, Oramel Ainsworth

Surber, Nathan Courtney

BUTTE—Hanes, Vincent Eugene

Sloss, Laurence Louis

COLUMBUS—Grant, Paul A.

CUT BANK—Hupp, John Ervin

McCourt, James H.

Postle, Gordon Leo

HELENA—Ellis, John Reese

NYE—Broedel, Carl Huntington

SHELBY—Blint, John Elmer

Cobban, William Aubrey

NEBRASKA

BLAIR—Newell, Donald Frost

FALLS CITY—Buck, Charles E.

Clark, James Edward

Earl, Will F.

Huffman, Edward Archibald

LINCOLN—Lugn, A. L.

Reed, Eugene C.

Scherer, Oliver J.

Schramm, E. Frank

Thomas, Harold S.

Tichy, James Robert

SEWARD—Rogers, Wilbur Frank

NEW HAMPSHIRE

HANOVER

Larrabee, David Marcel

NEW JERSEY

ASBURY PARK

Loring, Ralph Crapo

ELIZABETH

Jamesson, Maynard Hugh

GREEN VILLAGE

Conway, William Palen, Jr.

MAHWAH—Brazill, James Joseph

METUCHEN—Rhodes, Edward J.

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Siegel, Frank
NEW BRUNSWICK
 Hayes, Albert O.
PRINCETON
 Fox, Steven Knowlton
 Knight, J. Brookes
 Maxwell John Crawford
 Sampson, Edward
 Thom, W. T., Jr.
SOMERVILLE
 Smith, Norman Cutler
TENAFLY—Lilley, Ernest R.
TRENTON
 Sharkey, Henry Howe Robbins
UNION CITY—Nordman, O. E.
WESTFIELD—Flude, John William

NEW MEXICO

ALBUQUERQUE—Reiche, Parry
ARTESIA
 Yates, Harvey Emmons
CARLSBAD—Adams, John Emery
 Harley G. Townsend
 Riggs, George D.
 Wheeler, Robert Reid
 Wills, Neil H.
HOBBS—Boss, Reuel Lee
 Davis, Roger Hugh
 Kotzva, Fred Frank
 Madera, Fred
 Miller, Charles Parmar
 Moore, Joe Hiram
 Scott, Wilton Elege
 Staley, C. Glenn
 Tanner, Hugh A.
JAL—Davis, William Kenneth
ROSOWELL—Barnett, John Abner
 Headley, Joseph B.
 Thurman, Franklin A.
SANTA FE
 Collins, Jack Beverly
 Maxwell, Ross Allen
SILVER CITY
 Rothrock, Howard E.
SOCORRO
 Bates, Robert Latimer
SONORA
 Dodge, Theodore Ayrault

NEW YORK

ALBANY—Myers, Clay Kenton
BRONXVILLE—Naramore, Chester
BUFFALO—Reeves, John R.
CANTON—Brown, Robert Wesley
GLOVERSVILLE—Olson, Axel A.
ITHACA—Harris, Gilbert D.
 Nevin, Charles M.
 Palmer, Katherine V. W.
 Ries, Heinrich
 Willis, Clifford L.
LONG ISLAND—Farish, Linn M.
 Thompson, Lester S.
NEW YORK—Baker, Norval E.
 Baker, Raymond F.
 Bartlett, Fred W.
 Behre, Charles H., Jr.
 Blecker, Edward S.
 Bowles, Edgar Oliver
 Breed, Edgar R., Jr.
 Brodie, Gerson Herzl
 Brokaw, Albert D.
 Bronner, Finn Eyolf
 Butterworth, E. M.
 Clapp, Frederick G.
 Cobb, Margaret C.
 Condit, D. Dale
 Corbett, Clifton S.
 Coryell, Horace N.
 Cotner, Victor
 Cox, Benjamin Burton
 Crum, Harry E.
 Davis, Robert J.
 Dinsmoor, Carlton G.
 Dixon, A. Faison
 Dresser, Myron A.
 Eagles, Homer M.
 Echols, Dorothy Jung
 Ely, Fred B.
 Estabrook, Edward L.
 Fath, A. E.
 Finch, John Wellington
 Flagler, C. W.
 Foley, Edward J.
 Fuellhart, Donald E.
 Garnjost, Frederick W.
 Greig, Douglas A.
 Hamilton, Charles W.
 Hayney, Winthrop P.
 Helis, James
 Herald, Frank A.
 Herold, John Sublett
 Hindes, Earl P.
 Holman, Eugene
 Hubbard, Bela
 Jablonski, Eugene
 Kalb, John L.
 Kay, Fred H.
 Kay, G. Marshall
 Kinney, Harry D.
 Knebel, G. Moses
 Knutson, Clarence J.
 Kraft, Philip
 Langlois, Alice
 Lewis, J. Whitney
 Lovejoy, John M.
 McCobb, Harry W.
 McCulloch, Joseph P.
 McKee, H. Harper
 Miller, William Dana
 Milstein, M.
 Munoz, Robert R.
 Newhouse, Lester
 Olson, Walter S.
 Paige, Sidney
 Pertusio, Serge M.
 Pogue, Joseph E.
 Pratt, Wallace E.
 Reeves, Frank
 Rogatz, Henry
 Sealey, Fred C.
 Skeels, Dorr Covell
 St. Clair, Stuart
 Stebinger, Eugene
 Stone, Solon Wallingford
 Taylor, Ralph E.
 van der Linden, B. H.
 von Estoff, Fritz E.
 Walters, Ray P.
 Washburne, Chester W.
 Wasson, Harold J.
 Weeks, Lewis G.
 Whetzel, Raymond Victor
 White, Kessack D.
 Whiton, Herman F.
 Winkler, Bruno Oscar
 Zavoico, Basil B.
POUGHKEEPSIE
 Roig, Chester A., Jr.
 Warthin, Aldred S., Jr.
ROCHESTER
 Grossman, William Lewis
 Reed, Charles Merton
 Singewald, Quentin D.
ROME—Tyler, Henry Johnson
SCHENECTADY
 Holland, Aaron Elisha
SCOTIA—Oliver, Richard R.
SYRACUSE—Apfel, Earl T.
WELLSVILLE
 Young, Wilber H., Jr.

NORTH CAROLINA

CAMP BUTNER
 McCoy, George Young
CHAPEL HILL
 Huddle, John Warfield
 McCampbell, John Caldwell
FORT BRAGG—Kivi, Wilho John
MOREHEAD CITY
 Potsch, John Peter
NEW RIVER—Noll, Donald E.

NORTH DAKOTA

BISMARCK—Downs, George Reed
 Hennen, Ray V.
GRAND FORKS
 Laird, Wilson Morrow

OHIO

CINCINNATI—Caster, Kenneth E.
 Rich, John L.
 Rogers, Maynard
CLEVELAND
 McCloy, Walter Lowrie, Jr.
 Newell, Harlan Willard
 Robinson, J. French
 Selover, Joseph Britton
 Smoots, John P.
CLIFTON
 McCullough, A. Stafford
COLUMBUS—Lockett, J. R.
 Ring, Dewitt T.
 Spieker, Edmund M.
DAYTON—Neer, Carl J.
FINDLAY—Donnell, James C.
 Emery, Wilson B.
 Funk, Fred J.
 Koenig, Ralph A.
 Shade, E. Bruce
 Thomas, George Terrell
 Walter, Henry Glenn
HAMILTON—Engel, Noel W.
LAKEWOOD
 Girdler, Tom Mercer, Jr.
LIMA—MacDonnell, James A.
MAUMEE
 Sherwin, Melville William
TOLEDO—Lindberg, George David

OKLAHOMA

ADA—Jones, Boone
 Rixleben, Bruno
 Simpson, Richard W.
ALTUS—Nance, James Weldon
ARDMORE—Bartram, Paul L.
 Callahan, Drury V.
 Conger, Lauren Tenney
 Edstrom, Donald Edwin
 Fell, Harold B.
 Gill, Joseph Powers
 Lindner, Joseph Leicht
 Marshall, John
 Milner, Charles A., Jr.
 Neighbor, Frank
 Neustadt, Walter, Jr.
 Pickering, Warren Vale
 Ross, Stanford Leland
 Sappington, Chester
 Tomlinson, Charles W.
 Westheimer, Jerome M.
 White, Maynard P.
BARTLESVILLE
 Absher, William F.
 Allen, Harris Hayes
 Ambrose, A. W.
 Barclay, Stewart
 Beck, August F.
 Charles, Homer H.
 Clark, Robert P.
 Courtier, William H.
 Crumley, Rial Fleming, Jr.
 Damon, Fredric Thomas
 Dietert, Arthur E.
 Dunbar, Robert O.
 Durham, James Harmon
 Elliott, George R.
 Forward, Fred W.
 Graham, B. L.
 Hiestand, Thomas C.
 Hintze, Alma Jones
 Hoffman, Charles C.
 Johnson, Lester Hayden
 Jones, Daniel John
 Kidd, Robert L.
 Lounsbey, D. E.
 Miller, Vincent
 Moss, Rycroft G.
 Murphy, P. C.
 Myers, LeMoyné Ward
 Nisbet, John M.
 O'Keefe, Hugh W.
 Olson, Walter Sigfried
 Reid, Robert P.
 Riise, John Anderssen, Jr.
 Sands, J. M.
 Stirtz, W. Melvin
 Thompson, Edwin Ivor
 Utterback, Claude
 Weirich, T. E.
 Wells, Murray J.
 Wilhelm, Arthur K.
BRISTOW
 Bisbee, Wallace Alexander
CEMENT—Worrell, Frank Hansen
CHANDLER—Wagner, J. Basil
CHICKASHA—Engleman, Rolf
COWETA—Vernon, I. J.
 Oden, Arthur Jack
CUSHING—Ellison, Charles W.
DUNCAN—Boone, Dan Eugene
 Gouin, Frank
 Hornung, Arthur C.
 Parsons, Claude P.
 Smalley, Claire F.
DURANT—Montgomery, Phil C.
EDMOND—Crockett, Harry Lee
 Miller, Harry A.
 Relif, George O., Jr.
ENID—Clifton, R. L.
 Ford, Carl S.
 Lillibridge, Harry E.
 McKay, Alexander Ewing
 Ostrander, Allen Roys
 Reeves, J. R.
 Van Zant, James H.
FORT SILL—Bush, Robert Ewell
 Durgan, Herbert Leonard
 Gardner, Frank Johnson
 Hauptman, Herman Ray, Jr.
 Suffield, Harry Franklin
GUTHRIE—Allon, Meyer Michael
HENRYETTA
 Davis, Leon Virgil
 Morris, Walter W.
HOBART—Russom, Vaughn W.
 Jay—Valerius, M. M.
KONAWA—Jordan, J. B.
LAWTON
 Cross, Margaret Alice Tribble
 Hinson, Hillard
MADILL—Brillhard, Norman W.
 Northrip, Gerald Albert
MCALISTER—Jones, Charles T.
MUSKOGEE
 Thams, William Hoover
NASH—Wethington, William O.
NELSON—Bryan, Frank
NEWKIRK
 Fisher, Theodore Glen
NORMAN
 Bednar, William Carr
 Burke, Doyle Michael
 Cloud, Wilbur F.
 Decker, Charles E.
 Dott, Robert H.
 Gibson, George Drew
 Gould, Charles N.
 Ham, William Eugene
 Lahreker, Cecil Gordon
 Melton, Frank Armon
 Mills, Ruben C., Jr.
 Monnett, V. E.
 Oakes, Malcolm C.
 Pakiser, Louis Charles, Jr.
 Wadsack, George E., Jr.
OKTOLA
 Anderson, Oscar Samuel, Jr.
OKLAHOMA CITY
 Akers, Wilburn Holt
 Bale, Hubert E.
 Ballard, William Norval
 Brauchli, R. W.

- Brown, H. Travis
Brown, Vergil Neal
Burruss, George Howard
Buttram, Frank
Camp, Richard W.
Carpenter, M. E.
Clinkscales, Albert S.
Coleman, Tom L.
Conkling, R. A.
Dahlgren, Elmer George
Davis, Clyde E.
Ellison, Kenneth A.
Faust, Josef
Frizzell, Mildred V.
Glass, Theodore Gunter
Hamilton, Clarence Edgar
Hart, Raymond M.
Henderson, Dorothy Jane
Hicks, Ira Curtis
Hoke, T. C.
Hoover, F. Mabry
Howard, Dan O.
Hurry, Floyd Phillip
Jenkins, Harold D.
Jones, Roy D.
Keeler, Clifton M.
Kite, William C.
Latta, Lee Allen
Laughbaum, Graydon H.
Laughlin, Roland W.
Lynn, Robert H.
McFarland, Earl R.
McGee, D. A.
Miller, Willard L.
Montgomery, A. J.
Moreman, Walter L.
Newby, Jerry B.
Nichols, Paul B.
Norville, Glen S.
Obern, D. W.
Pasquella, George Graham
Patterson, Luther Edwin, Jr.
Perrine, Irving
Pollard, Robert T.
Ramsey, Charles E.
Renick, B. Coleman
Richards, A. Howard
Richards, J. T.
Sartain, Maxwell Roland
Schaeffer, Hugh C.
Schweer, Henry F.
Sears, Joseph McHutchon
Shields, Fred C.
Sinsey, Everett Weston
Smith, Gerald N.
Swesnik, Robert Malcolm
Taylor, Charles H.
Turner, George Raymond
Van Dail, John E.
Whiting, Lester Leroy
Woodward, George E., Jr.
Yoakam, Coler A.
- OKMULGEE**—Uri, Joseph John
Wise, James Sharples
- PONCA CITY**—Athy, Lawrence F.
Boyd, W. Baxter
Clark, Glenn C.
Clark, Stuart K.
Ewing, Rudolph V.
Hunter, Robert E. Lee
Hurd, E. Gordon
Mills, R. van A.
Morgan, D. M.
Parker, Everett C.
Prescott, Harold Raymond
Prokesh, Hugh E.
Royds, James Stanfield
Ryan, Thomas Patrick
- PRAGUE**
Klabzuba, Robert Ernest
SAPULPA—MacKay, Hugh
- SEMINOLE**
Barrett, Henry Haldred
Ehlers, Allen
Hyatt, Don L.
Kline, Robert Walter
- Moore, Carl Allphin
Runyan, E. L.
- SHAWNEE**—Bazhaw, Willis Oliver
Brown, Robert
Campo, Henry Andrew
Carpenter, Everett
Cassingham, Robert L.
Dawson, Edwin A.
DeLong, James Alfred
Gahring, William Ross
Goodman, P. W.
Hestbeck, Marion E.
Hoyle, Charles R.
Johnston, John C.
Kittredge, Frank R.
Kittredge, M. B.
Lehman, Roy P.
Maravich, Milan D.
McAninch, Roy David
Meyer, Arthur M.
Mitchell, Robert Oliphant
Muir, J. Lawrence
Owen, Elwyn Ronald
Quiet, Roy C.
Rau, Harold L.
Roberts, M. C.
Spangler, Grant W.
Veeder, John A.
Wallace, P. A.
- Wright, Thomas Goodman
STILWELL—Hawes, Julian
SULZBURG—Wynn, Hal C.
- TULSA**—Ackers, A. L.
Albert, Emil Richard, Jr.
Allen, William Odie, Jr.
Arnold, Henry C.
Arnold, Lincoln Merchant
Bace, A. C.
Bartram, John G.
Bass, Nathan W.
Bates, R. P.
Beck, Elfred
Becker, Dwight Lyman
Becker, Herman Carroll
Beekly, Albert L.
Bennett, Frank Orville
Bernard, W. E.
Berwald, W. B.
Bishop, Francis Luther
Bleakley, Alfred Bishop
Bloesch, Edward
Bohart, Philip H.
Borden, Joseph L.
Born, William Theodore
Brant, Ralph A.
Brice, John W.
Brown, Harry J.
Brown, Merritt H.
Buckstaff, Sherwood
Bullard, Edgar F.
Bush, Frederic A.
Butt, William Horace
Carlson, Charles G.
Carter, R. W.
Case, Leslie C.
Case, William B.
Chapman, Martin Edward
Claiborne, Ray E.
Clark, Frank Rinker
Clark, Howard
Clark, Joseph M.
Clark, L. W.
Clarke, Ralph L.
Clote, Thomas Anthony
Coffin, R. Clare
Conhaim, Howard J.
Conley, J. N.
Cornelius, Lee Henri
Coryn, F. R.
Cullen, Ronald J.
Cumming, Alfred
Dannenberg, R. M.
Davis, Sidney Hugh
Denison, A. R.
Desjardins, Louis Hosea
Devin, Fred A.
- Dillard W. Reese
Dille, Glenn Scott
Downing, Roswell B.
Dunlap, George Elmer
Eckenwiler, Cloe W.
Egan, John A.
Eirich, Constance G.
Elson, William H.
Emrick, D. G.
Evans, Noel
Feagin, Barney, Jr.
Ferry, Dan Edwards
Ferguson, John L.
Finley, Jean Carson
Fitts, L. E., Jr.
Fitzgerald, Paul E.
Fosshage, Ernest Willard
Galbreath, Glenn G.
Gardner, James H.
Garrett, Robert E.
Gartner, James L.
Gawthrop, R. M.
Gilbert, Thomas Harold
Gilmour, Andrew
Giltinan, George Murray
Ginter, Roy LaMont
Goodrich, Harold B.
Graeber, Clyde Provolt
Graham, Will Lee
Green, Thomas Henning
Green, William Gladstone
Griffith, Glenn R. V.
Grisby, R. B.
Guffey, Vernon E.
Hall, Dollie Radler
Hamilton, Robert G.
Hamner, Francis Merrick
Hardison, George Porter
Harlton, Bruce H.
Harris, Seward F.
Hatcher, Oscar
Hawkins, Glenn D.
Hawkes, Wendall Homer
Hawkins, Allen Gentry
Heeren, Julius A.
Henry, William Wirt
Hewett, Charles Francis
Hier, Charles Douglas
Hill, Orval Hall
Hill, V. G.
Holston, Alvin Arthur
Hoover, James B.
Hopper, Walter E.
Horkey, William E.
Horner, William L.
Hosterman, John F.
Howard, W. V.
Howell, Jesse V.
Hower, S. Grace
Hudgens, Clyde O.
Hughes, Richard
Hull, J. P. D.
Hunt, Lenora May
Innes, Arland Irving
Janovy, John
Johns, Walter Wendell Schell
Jones, Leland W.
Kauffman, James S.
Kennedy, Luther E.
Kiess, Myron C.
Kimball, Kent K.
King, Charles C.
Kirk, Charles T.
Kister, Herbert H.
Kleen, Harold J.
Knappen, Russell S.
Kravis, Raymond F.
Kridler, George M.
Kunsman, Howard Smith
Kyle, Jerry Robert
Lambert, Gerald S.
Lane, Charles W.
Lang, William J.
Larkin, Pierce
Larson, Carl L., Jr.
Leach, Thomas W.
- Leatherock, Constance
Leiser, J. B.
Lester, O. C., Jr.
Levorsen, A. I.
Lilienborg, Burton Armand
Littlefield, Max S.
Lukert, Louis H.
Lund, Wesley R.
Lyons, Paul L.
Maples, Steve Campbell
Markham, Edmond O.
Markley, Elmer A.
Marmaduke, Richard C.
Matson, Thomas Edwards
McCollum, Leonard F.
McCoy, Alex W.
McCrary, E. W.
McEachin, Wright Daniel
McGill, James N.
McIntyre, Paul J.
McMillen, Raymond F.
Merritt, John W.
Milek, Andrew
Miller, Buford Maxwell
Miller, Wendell Z.
Millikan, Charles V.
Millison, Clark
Monahan, Foster Murray
Moore, Homer Clarence
Moore, Kenneth B.
Moreno, Joseph E.
Morley, Harold T.
Mosburg, Lewis G.
Moses, Harold F.
Mossman, Reuel Wallace
Murphy, James K.
Murray, Albert N.
Muselman, George Abraham
Neal, Eugene Preston
Nelmark, John H.
Neumann, L. Murray
Newman, Thomas F.
Norling, Donald L.
Nufer, D. C.
Oliphant, A. G.
Paterson, Robert
Patton, Roger R.
Peabody, Harlan W.
Peaker, Don H.
Perry, Waynard Burton
Pierce, Harold Frederick
Powell, Ralph S.
Price, James A.
Price, Sylvan S.
Probst, Karl Max
Rae, Colin C.
Randall, Duane Chilton
Redfield, John S.
Reisher, Paul H.
Renfro, Harold Bell
Reynolds, Karl W.
Richards, Raymond
Rickard, Hilton Lloyd
Riggs, Robert J.
Roark, Edward L.
Roark, Louis
Roark, Louis Claude
Roark, Ralph B.
Ross, Charles M.
Russell, William L.
Rutledge, Richard B.
Ryniker, Charles
Scott, H. M.
Scott, Horace L.
Scudder, Ernest W.
Seaman, L. O.
Shamblin, William Earle
Sharpe, Joseph Audley
Shea, Edward F.
Sherry, William J.
Shutt, Roscoe E.
Silverman, Daniel
Sinclair, William B.
Siverson, Garfield C.
Sloan, Raymond D.
Snow, Dale R.

Solliday, Albert LaFayette
 Spahr, Marshall Richard
 St. Clair, Donald W.
 Stoker, Carl E.
 Stoner, O. E.
 Stotler, Raymond Tracy, Jr.
 Strachan, Clyde G.
 Stump, Mark Eugene
 Tandy, J. Hiram
 Tarr, Russell S.
 Tarver, Earl A.
 Taylor, Garvin L.
 Teis, Maurice R.
 Templeton, James B.
 Thomsen, Erik
 Tillotson, Allen W.
 Travis, Abe
 Truex, Arthur F.
 Tuttle, Richard Carol
 Upp, Jerry E.
 Vernon, Jess
 Wagner, Carl D.
 Wagner, Clyde L.
 Wagoner, George E.
 Walls, Elmer Dennis
 Walker, Lucian H.
 Wanenmacher, Joseph M.
 Watson, Joseph D.
 Weatherby, Benjamin B.
 Weimer, Frank G.
 Welch, Virgil H.
 Wellman, Dean C.
 Wenberg, Edwin Hugo
 Westby, Gerald H.
 White, Kirk Schroder
 Luther, H. H.
 Wilcox, Stanley William
 Willis, S. Morse
 Wilsire, L. M.
 Wilson, Walter B.
 Wines, Donald Bradford
 Wood, Robert H.
 Wood, Virgil O.
 Woods, Sam H.
 Wright, Harry F.
 Wyman, Everett A.
 Younkman, Harry D.
 Zoller, Lawrence J.
 WATONGA—Kolm, Paul H.
 WAKOMIS—Noland, Orval W.
 WAUKIKA—Robins, Anne Moring
 YALE—Hancock, Bob
 YUKON—Goudy, Louis Willard

OREGON

CAMP ADAIR
 Thrasher, Glen Clair
 PORTLAND—Williston, Samuel H.

PENNSYLVANIA

BRADFORD—Dickey, Parke A.
 Eckert, Frank E.
 Fralich, Charles Eugene
 Renfro, Charles A.
 Simmons, Arthur Carlisle
 Stephens, Maynard Moody
 BRYN MAWR—Dryden, Lincoln
 CLARION—Arnold, Harry H., Jr.
 COOPERSTOWN—Small, Walt M.
 COUDERSPORT
 Cole, Adna Malone
 Whortan, Chester D.
 DELMONT
 Zimmerman, James Z.
 EASTON—Ward, Freeman
 GERMAN TOWN—Giles, John M.
 MONONGAHELA—Wood, George R.
 NORTHUMBERLAND
 Jones, J. Byron
 OLE CITY
 Montgomery, James G., Jr.
 Secor, Donald T.
 Seifert, Wilbur H.
 PHILADELPHIA
 Bradish, Beverly B.
 Ellis, George L.

Griley, Horace L.
 Harris, Richard C.
 Lindsly, Ben E.
 Pike, Sumner Tucker
 Weeks, Herbert J.
 White, Tell Thompson
 PITTSBURGH
 Allen, Frank Tilbury
 Backman, John Edward
 Bayles, Robert Ellery
 Boots, Paul Heath
 Brankstone, Hugh R.
 Bristley, Leon Prestridge, Jr.
 Busch, Daniel Adolph
 Davis, Ralph E.
 Eckhardt, E. A.
 Fetteke, Charles R.
 Finn, Fenton Harrison
 Foster, Alden W.
 Gale, John Taylor
 Galpin, Sidney Stewart
 Gealy, Wendell B.
 Gemmell, Howard Frederick
 Goodman, John Vollmer
 Grow, George Copernicus, Jr.
 Gully, M. Gordon
 Hastings, Wynn K.
 Head, K. C.
 Heater, W. E.
 Hopkins, Richard Holmes
 Kerbow, Russell B.
 Ketterer, Walter Philip
 Lang, Ralph H.
 Melchior, Louis Francis
 Meszaros, William Andrew
 Nettleton, L. L.
 Newlon, John Hawker
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 Rand, Wendell P.
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 Sherrill, Richard E.
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 PROSPECT—Shaffer, John M.
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 STATE COLLEGE
 Krynine, Paul D.
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 STRAFFORD
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SOUTH CAROLINA

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 CHESNEE—Mullinax, Jack D.

SOUTH DAKOTA

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TENNESSEE

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 KNOXVILLE
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TEXAS

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 Orman, Freeman L., Jr.
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 BROWNFIELD
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 BROWNSVILLE
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 CAMP BOWIE
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 CAMP HOOD—Lake, James L., Jr.
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 COLLEGE STATION
 Hartley, Burton
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 CORPUS CHRISTI
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 Bong, Carl P.
 Buck, Cleo Eugene
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 Hansell, James Myron
 Heaton, Adrian H.
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 Herring, L. B.
 Isenberger, Nate P.
 Jolley, Durward N.
 Kelsey, Lewis O.
 Maley, Willis A.
 McCallum, Henry D.
 McClain, Orville Graves
 Miller, Carroll C.
 Nelson, Raymond Thomas
 Owens, Frith C.
 Parrish, Gaston H.
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 Ross, Donald Alexander
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 Seever, Harris N.
 Smith, Floyd Clayton
 Stein, Ira H.
 Swiger, Raul B.
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 Tagel, Edwin A.
 Taylor, Surce John
 Teagle, John
 Travis, Joe Johnson
 Tucker, Reagan
 West, Lloyd G.
 CORPUS CHRISTI
 Bescher, Earl, Jr.
 Fish, Leroy
 Martin, John Charles, Jr.
 CROCKETT—Brier, Ervin Ernest
 Iversen, William G.
 CROWELL
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 CUERO—Dexter, Laurence N.

DAINGERFIELD

Anderson, George H.
 DALLAS—Agnich, Fred J.
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 Anderson, Frank Marion
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 Bostick, J. Wallace
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 Brooks, Olin D.
 Burckhard, Frederic L.
 Burgess, V. N.
 Burress, Walter M.
 Byrd, David Harold
 Carpenter, Charles B.
 Carter, Dewey V.
 Cesinger, E. F.
 Clark, John W.
 Clawson, William W.
 Collingwood, D. M.
 Collins, C. Philip
 Corman, Hyman
 Cortes, Henry C.
 Cox, Wesley Philip
 Crawford, David J.
 Curry, William H., Jr.
 DeGolyer, E.
 Deputy, P. R.
 Doering, John
 Eckart, Robert R., Jr.
 English, Leon E.
 Estergren, Edmund Frederick
 Fisher, Barney
 Fosdick, Arthur R.
 Fouts, John M., Jr.
 Frost, Jack
 Garner, Aubrey H.
 Garrett, Melvin M.
 Germany, Eugene Ben
 Gilmore, Kathleen Kirk
 Gray, Alfred
 Gray, Cecil Howard
 Guthrie, Robert Keith
 Hager, Dilworth S.
 Hamm, W. Dow
 Headington, Clare Wesley
 Heath, Francis E.
 Hill, Harry B.
 Hudson, William Taylor
 Joekel, Fred E.
 Jordan, Louise
 Karcher, John C.
 Kelsey, Martin C.
 Kendrick, Frank E.
 Knox, T. K.
 Kraus, Edgar
 Lahee, Frederic H.
 Laves, U. R.
 Lewis, James Albert
 Lloyd, Abe M.
 Love, Perry R.
 Luman, Edmondson D.
 MacNaughton, Lewis W.
 McDermott, Eugene
 McFarland, Paul W.
 McFarland, Russell S.
 McLeod, Angus
 Menefee, James C.
 Meredith, Carlton
 Meyer, Willis G.
 Morgan, Henry J., Jr.
 Nash, Paul E.
 Newton, William Wilson
 Norton, George H.
 Oldham, Albert E.
 Pernell, James Herbert
 Pittman, Chalmers Van A.
 Ralston, Wallace
 Ransone, William Robert
 Reager, Edward C.
 Rettger, Robert E.
 Rider, Charles R.
 Robinson, Heath M.

Rowden, Dale Henry

Russ, Leon F.
 Russell, Philip G.
 Sale, Clarence M.
 Schultz, Frank August
 Schwarz, Melbert E.
 Slater, Kenneth C.
 Seale, Robert I.
 Shearer, Louis Hollis
 Sheldon, Wichita F.
 Shuler, Ellis W.
 Simkins, J. J.
 Smith, Eugene Wilford
 Smith, J. Fred, Jr.
 Stehr, Raymond A.
 Stevens, Nelson Pierce
 Tapper, Wilfred Bonno
 Teas, Paul C.
 Teichman, Joseph Bernard
 Thompson, Sheridan A.
 Tucker, Robert Louis
 Vanderpool, Harold C.
 Walton, Oscar Edward
 Waters, James A.
 White, Rex Harding
 Williams, Charles Coburn
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 Wilson, Joseph M.
 Wilson, Malcolm E.
 DENISON—Clark, Lanham Todd
 Trenchard, John
 DENTON—Adams, Robert James
 Bonar, Robert Emerson
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 EAGLE—Moir, John
 EASTLAND—Perkins, Joseph M.
 EDINBURG—Coel, Eustace J.
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 EL PASO—Millard, William J.
 Nelson, Lloyd A.
 FLOYDADA—Davis, Lon, Jr.
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 Adkisson, Albert W.
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 Bass, Perry R.
 Benton, Louis B.
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 Bradish, Ford
 Brown, J. Earle
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 Casteel, Sanford H.
 Christie, Robert S.
 Christner, D. D.
 Clark, H. Smith
 Cordry, C. D.
 Cummins, Ralph H.
 Dean, D. P.
 Dean, P. C.
 Donoghue, David
 Dudley, Raymond W.
 Fash, Ralph H.
 Fisher, Gordon Henderson
 Freedman, Louis H.
 Fuqua, H. B.
 Gill, J. Willard
 Goodrich, Robert D.
 Gray, Donald Arthur
 Hampton, James David
 Harbison, Robert Ranney
 Harris, Sidon
 Hilseweck, William Joseph
 Hudson, William A.
 Hyde, Clarence E.
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 Johnston, Lois Louise
 Kennedy, Joseph B., Jr.
 Lee, Lynn K.
 Lovejoy, J. B.
 Lozo, Francis Edgar, Jr.
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 Maverick, Phillip
 McClure, Harold Y.

McCune, Paul

Mohr, C. L.
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 Mygdal, Karl A.
 Nicol, David
 Nolte, William J.
 Pilcher, Ben L., Jr.
 Poulsen, Frank E.
 Reeves, Frank W.
 Renaud, Charles L.
 Reynolds, Roy A.
 Romine, Thomas B.
 Schempi, Foster John
 Schouten, Franklin H.
 Schweers, Richard Henry
 Scott, Gayle
 Smith, Ralph E.
 Snelbold, William F.
 Stookey, Donald G.
 Thomas, J. Elmer
 Thompson, Benedict E.
 Thompson, R. R.
 Upson, M. E.
 Van Steenbergh, Samuel K.
 Weaver, George A.
 Whisenant, J. Barney
 Wilson, John H.
 Winton, Will M.
 Yager, Charles E.
 GALVESTON
 Zinke, Ernest Clarence
 GENOA—Clark, Paul Henry
 GLEN ROSE
 Bartley, Jerald Howard
 GONZALES—Hagen, Cecil Vernon
 GRAHAM—Russell, Hewlett A.
 GREENVILLE—Hood, Forest W.
 McNutt, Gordon Russell
 GROESBECK—Whitcomb, Bruce
 HALLETTSVILLE
 Manes, Oscar Bob
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 HENRIETTA
 Harder, Banhart Pete
 HOUSTON—Adams, Frank C.
 Adams, W. C.
 Adkins, W. S.
 Adler, Joseph L.
 Akkerman, Richard Pete
 Albertson, Maurice M.
 Allen, Stanley R.
 Allison, A. P.
 Anderson, John G., Jr.
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 Baker, William A., Jr.
 Baldwin, E. B.
 Banta, Henry Eugene
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 Barragy, Edward J.
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 Bay, Harry X.
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 Bejharz, Carl F.
 Bell, Douglas E.
 Bell, Olin G.
 Belt, Ben C.
 Benish, Robert Lowell
 Bennett, Malcolm Dorden, Jr.
 Benson, Don G.
 Berg, Gilman A.
 Best, J. Boyd
 Black, Jo Pat
 Blackburn, Willis C.
 Blanchard, J. B.
 Blanchard, Stanley W.
 Blau, Ludwig Wilhelm
 Bleyberg, Arnold
 Bocock, Oscar Lafayette
 Bolinger, John Wiley
 Booth, Robert T.

Born, Howard Raymond
 Bostick, Francis Xavier
 Bowles, R. C.
 Bowling, Leslie
 Bowman, Wayne F.
 Boyles, James M.
 Brace, Orval L.
 Bradford, Charles Edward
 Brehm, Ralph C.
 Briard, Vernon E.
 Bricker, John F.
 Brokaw, John M., Jr.
 Broussard, David Franklin
 Broussard, Lloyd J.
 Broussard, Marion U.
 Brown, Hart
 Brown, Samuel B.
 Bryere, Alan
 Bryan, Carl L.
 Buchanan, George S.
 Buck, E. O.
 Buck, Nina M.
 Bugbee, James McKean
 Bunsen, Albert Washington
 Burchfiel, Hugh Lee
 Byers, John William
 Calohan, William F.
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 Cartwright, Lon D., Jr.
 Casey, Sam Russell, Jr.
 Cashin, D'Arcy M.
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 Childerhouse, Allen J.
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 Clark, William A., Jr.
 Clark, Willis Kenley
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 Collett, J. Daviss, Jr.
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 Cruse, John S., Jr.
 Culbertson, John Archer
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 Darling, Jack N.
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 Davis, Flavy Eugene
 Davis, Morgan J.
 Decker, LaVerne
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 Deussen, Alexander
 Dissinger, Earl
 Doherty, Wilfred Thomas
 Dorr, James B.
 Durkee, Robert R.
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 Edson, Dwight J.
 Ellis, Albert D., Jr.
 Ellis, Alva C.
 Esquen, W. K.
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 Ferguson, Hershall Cevera
 Ferguson, Jack B.
 Ferguson, William Boyd
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 Flowers, Jack
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 Gahagan, Donald I.
 Galbraith, Thomas J.
 Gale, Arthur Sullivan, Jr.
 Galloway, Alan James

- Gardescu, Ionel I.
 Gardner, Edgar Jackson
 Garrett, Julius Benjamin, Jr.
 Garrett, Lovic P.
 Garst, Jarvis
 Getzendaner, A. E.
 Goldston, Walter L., Jr.
 Goldstone, Frank
 Goodrich, Raymond H.
 Gorman, Dugald
 Gorman, William Albert
 Gray, Shapleigh G.
 Gray, William D.
 Griffin, Irving M., Jr.
 Grinsfelder, Sam
 Grogan, Samuel A.
 Grosjean, Robert
 Guyod, Hubert
 Hafner, W.
 Hager, Lee
 Halbouty, Michel Thomas
 Hall, Thomas Ola
 Halsted, Morris E.
 Hamilton, James Raymond
 Hamman, John, Jr.
 Hamner, Edward John
 Hancock, William T., Jr.
 Hanna, Marcus A.
 Hansard, Charles O., Jr.
 Hansen, Malcolm B.
 Hardison, Harvey
 Harkins, Thurman I.
 Harrington, George Haymond
 Harvey, Castle J. C.
 Hasselmann, Karl F.
 Hedley, J. David
 Heid, Gordon W.
 Henderson, Marion Reece
 Herold, C. Lathrop
 Higgs, Morton T.
 Hoard, J. O.
 Holliday, Samuel
 Hopf, Robert William
 Hornberger, Joseph, Jr.
 Horvitz, Leo
 Housh, C. N.
 Hoyt, William V.
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 Hunter, Paul B.
 Hutchinson, Frederick M.
 Igau, Hubert C.
 Ikins, William Clyde
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 Jones, Wayne V.
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 Kerlin, Marcellus Leslie, Jr.
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 Langton, Claude M.
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 LaRue, Wilton W.
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 Leavenworth, Paul B.
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 Lewis, James O.
 Lewis, Paul S.
 Lewis, Raymond Charles
 Lewis, Wendell L.
 Lieb, Victor E.
- Lott, Alfred Walker
 Lowman, Shepard W.
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 Malkin, Doris S.
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 Martin, B. G.
 Martin, Benjamin Herbert
 Martyn, Phil F.
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 Mathieu, Jean Leon
 McCarter, W. Blair
 McDonnell, Haydon W.
 McFadden, William A., Jr.
 McFerron, George I.
 McGowan, F. H.
 McLellan, Hiram J.
 McMillan, Joseph M., Jr.
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 Michaux, Frank W., Jr.
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 Miller, Forrest J.
 Miller, John C.
 Milton, William B., Jr.
 Minor, H. E.
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 Mitchell, Robert B.
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 Morris, Louis Henry
 Morrison, T. E.
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 Mower, Lowell K.
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 Myers, John C.
 Myers, Julian Q.
 Nance, Albert G.
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 Nelson, Floyd A.
 Neuman, Leonard J.
 Nichols, Ralph G.
 Niven, Robert N.
 Noble, Homer A.
 O'Bannon, P. H.
 O'Donnell, Lawrence
 Ogg, Thomas A.
 Olcott, David Perry
 Orynski, Leonard W.
 Osterhoudt, Walter J.
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 Parsons, Kenneth R.
 Patrick, Walden W.
 Patterson, Archibald Balfour
 Pawley, Julian Kingsbury
 Paxson, Roland B.
 Peacock, Henry Bates
 Petty, Dabney E.
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 Pollard, Jack C.
 Potter, Nelson B.
 Powless, R. C.
 Pyeatt, Lloyd M.
 Rabensburg, Aubrey Henry
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 Ray, Robert Hillyer
 Reasoner, Melton A.
 Reed, Edwin M.
 Reddy, Milton Frank, Jr.
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 Reiter, Wilhelm A.
 Reynolds, Frank Fisher
 Richardson, Carl B.
 Riddle, James Irvin, Jr.
 Ries, Minette
 Roberts, Dwight C.
 Roberts, Louis C., Jr.
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 Rose, Nicholas A.
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 Russell, C. A.
 Sample, Charles Hurst
 Sanders, C. W., Jr.
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 Sawtelle, George
 Say, Stanley R.
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 Schmidt, Karl A.
 Schmotzer, Julius William
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 Seren, Gordon Wilbur
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 Shay, D. C.
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 Sherar, Stuart
 Sisson, Harry Hensel
 Smiser, Jerome S.
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 Smith, Erwin W.
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 Smith, Gerald J.
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 Steig, Maynard H.
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 Stephenson, Elizabeth Earl
 Stephenson, Morton B.
 Stevens, George D.
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 Still, John T.
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 Swigart, T. E.
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 Tatum, Emmett P., Jr.
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 Teague, James Udell
 Teas, L. P.
 Teten, Robert Paul
 Thomas, James W.
 Thompson, Evan G.
 Thompson, John P.
 Thompson, Wallace C.
 Timm, Bert Clifford
 Torrey, Paul D.
 Trager, Hugh Harold
 Troxell, John N.
 Tucker, Reese Herrick
 Tyson, Alfred K.
 Urbom, Oscar William
 Van Burgh, Lisle R.
 Van Eaton, Raymond Andrew
 Van Melle, Francois A.
 van Weelden, A.
 Vaudoit, Paul L.
 Vetter, John M.
 Voigt, Harold E.
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 Wade, Wallace Lee
 Wallace, David M.
 Ward, Roderick C.
 Warner, Charles A.
 Warren, Howard C.
 Weatherston, Douglas
 Weaver, Paul
 Weingartner, R. A.
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 White, Gordon H.
 Wilhelm, Oscar G.
 Williams, Herbert E.
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 Wilson, Forest Wayne
 Wolf, Albert G.
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 Zaba, Joseph
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 IRAAN—Gregory, Peter Paul
 JASPER
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 LAMESA
 Adams, Kilburn Elie, Jr.
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 LLANO—Stratton, J. Lynn
 LOCKHART
 Lincoln, William Wilkinson
 Wiegand, Frederick William
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 LONGVIEW—Sumner, Walton
 LUBBOCK—Cantrell, Ralph B.
 Cooley, Ralph S.
 Crider, Lewis Calvin
 Dunn, David Arthur
 Elkins, Campbell Hill
 Evans, David Morgan
 Gibson, Donald Thomas
 Klaus, Hellmut
 Latch, Leonard
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 LULING—Woolsey, E. V.
 MADISONVILLE
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 MARSHALL
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 Bailey, Willard F.
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 Beckmann, Harry LeRoy
 Bingham, Neal J.
 Branson, Delmar O.
 Brock, Stephen W., Jr.
 Brown, Prentice F.
 Bucher, John Eric

MEMBERS

399

- Butcher, Cary P.
Canfield, Charles Reiter
Canon, Joe
Champion, Oscar R.
Chase, Carlos Louis
Clarke, Robert L.
Coil, Fay
Cole, Charles Taylor
Cox, Robert T.
Crawford, Gayle P.
Crays, Glenn Edward
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DeFord, Ronald K.
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Farmer, Russell
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Hills, John Moore
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Hollingsworth, Richard Vincen
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Maley, Vaughn C.
McCarver, Alfred Gerald
McCullough, Edward Allen
McGuigan, Francis Henry
McKinsey, Mark Howard
Miller, Milward
Mills, Lloyd Clarence
Mix, C. A.
Moore, John I.
Moore, Lee Wayne
Moore, Prentiss D.
Oles, Paul S.
Osborn, William Macklin
Osborne, Paul F.
Park, Lee Brown
Parker, Thomas Reilly
Penn, William Y.
Petta, Joseph B.
Porterfield, Robert R.
Quigley, James Alonzo
- Rankin, Robert Estes
Ray, Bernard Arthur
Reed, Edward Looman, Jr.
Reigle, Edward E.
Roberts, Gerald C.
Rogers, Victor William
Schlosser, Paul A.
Schneider, William T.
Secor, Dana M.
Shaw, Charles Anderson
Skinner, John Wesley
Spencer, Maria
Stall, Trovall Lafayette
Steinberger, Clark R.
Terrill, John V.
Thomas, Leonard C.
Vanderpool, Eugene Ward
Vertrees, Charles D.
Wahlstrom, Edwin A.
Wallace, Louis Stacy
Warren, John Edwin
West, William Ward
Wilcox, Fred H.
Williams, Merv Dedrick
Winter, Niles B.
Woods, E. Hazen
Wright, Fred S.
Young, Addison
- MISSON—Daniel, Guy S.
Ware, T. Preston
- MONT BELVIEU
Chun, Harold August
- MONTGOMERY
Jackson, James Roy, Jr.
- MT. PLEASANT
Fowler, Henry Florey
Hodder, Roland Frederick
NEWGULF—Judson, Wilbur
ODESSA—Clark, Frank T.
OLNEY—Geyer, Robert Lloyd
ORANGE—Cardwell, William H.
OVERTON—Maxwell, Curtis Fred
Roberts, Charles V., Jr.
PALACIOS—Barnett, John F., Jr.
- PALESTINE
McReynolds, Gregg F.
Tieney, James A.
- PAMPA
Blanchard, Frank N., Jr.
Burkhead, Wayne Z.
Phillips, Joseph B., Jr.
Rogers, Jesse Armstead
Schwartz, Harold Edward
- PEARSALL
Fountain, Henry Coleman
PECOS—Samuell, John Howard
PHILLIPS—Ribble, John M.
PILOT POINT—Elljott, Andrew C.
- PLAINVIEW
Alexander, Walter Herbert, Jr.
- PLANO
Chaddick, William Monroe, Jr.
PORT ARTHUR—Irwin, Carl B.
RESEDA—Adams, Robert Wiley
RIESEL—Frazell, William Davis
RIVERSIDE—Weinzierl, John F.
- ROCKDALE
Wilson, James Ernest, Jr.
ROSENBERG—Scotgin, John Mills
Ustyunik, Edwin Frank
- SAN ANGELO—Cannon, Joe
Cannon, R. L.
Clarkson, William George, Jr.
Cottingham, Virgil E.
Dodson, Floyd C.
Emch, John W.
Gregory, J. N.
Hagan, Arthur M.
Ott, Emil
Ray, W. C.
Simpson, Roscoe M.
- SAN AUGUSTINE
Scott, Edward W.
- SAN ANTONIO
Absher, Kenneth B.
Alcorn, Avary Hunt
- Banks, Thomas R.
Benedum, Darwin
Bivens, Wilmer Edward, Jr.
Boehms, Eugene Field
Boyer, Will W.
Boyle, Walter J.
Breedlove, Robert Leeroy
Camp, John F., Jr.
Campbell, William Robert
Chapell, Donald Owen
Closuit, E. M.
Coates, George H.
Colton, Howard Franklin
Cooper, Herschel H.
Daubert, Charles A.
Daugherty, Clarence G., Jr.
Davis, Field M.
Davis, Thornton
Dawson, Joseph M.
Derden, J. H.
Douglas, L. A.
Dovre, Adolph
Durward, Robert Harold
Elms, Morris Allen
Eyssell, Alfred R.
Forney, Maurice Edgar
Gilbert, A. C., Jr.
Gish, Wesley G.
Green, Guy E.
Gross, Arthur B.
Hammond, Weldon W.
Haring, Louis Howard, Jr.
Harrell, Marshall A.
Harvey, William W.
Helmig, Phil D., Jr.
Henderson, H. H.
Herndon, Harold D.
Howe, Ralph H.
Howeth, Irving K.
Hunzicker, Vernon J.
Ingham, Albert Irwin
Johnson, Edward L.
Kearny, Clinton Charles
Kelley, Ward W.
Kennedy, Gilbert R.
Keppler, Leo G.
Kerr, James Lee
Kidd, Gentry
Kirby, Grady
Kniker, Hedwig T.
Kolm, Robert N.
Lawton, Joe
Ley, Henry A.
Magalis, Cyrus West
Mann, Robert Scott
Masterson, Reba B.
Matson, Martin
Mayfield, William Isaac
McAdams, Ronald Earl
McDonald, Worth W.
Mebane, Robert Duff
Menger, Hubert Emil
Miller, E. Floyd
Moore, Marion Jefferson
Morey, Philip Stockton
Morgan, George D.
Mossom, Stuart
Nelson, James C.
Nelson, Jean O.
Nessly, Walter E.
Newfarmer, Leo Ray
Nicholls, William M.
Osborne, Robert R.
Owen, Edgar W.
Palmer, Leland L.
Patterson, Joseph M.
Patton, John Barratt
Petrick, Glen
Petch, Arthur H.
Petty, Olive Scott
Petty, Van A., Jr.
Porch, Edwin L., Jr.
Potter, Grover C.
Preece, Rae
Ratliiff, Guy Marvin
Roberts, Homer Eugene
- Rogers, James K.
Ross, John C.
Row, Charles H.
Rudolph, Paul Jackson
Ryan, Reginald G.
Sandiger, John R.
Sandifer, Donald Ford
Schoeneck, Philip S.
Schoolfield, R. F.
Scott, Arvin Forrest
Semmes, Douglas R.
Shawe, Silas Frederick
Sheldon, Israel R.
Shelton, George H.
Sloss, James Parker
Snider, L. B.
Snow, Arthur Leland
Souther, John B.
Spice, William H., Jr.
Steubing, W. C.
Storm, Willis
Teel, Dick
Tobin, Don Freeman
Traupe, Lloyd Desmond
Wagener, Charles H.
Walker, Jule Hargis
Ward, J. H. E.
Warner, Ralph E.
Webb, James A.
Whitaker, Harvey
Winfrey, Donald B.
Witherspoon, Edgar
Wofford, Henry Kollins, Jr.
- SEALY
Hackbarth, Robert Earle
SEGUIN—Hostetter, Harry R.
Miller, Harold Oswald
- SEYMOUR
Kemp, Augusta Hasslock
Mort, Frank P.
- SHEPPARD FIELD
Mankin, Warren Ward
SINTOX—Dake, Helen Elizabeth
Fipps, E. L.
Tatum, James L.
- SKELLYTOWN
Bowsher, Arthur Leroy
SUNDOWN—Dana, Edward B.
TAYLOR—Grimes, Russell W.
- TEXARKANA
Allardyce, Robert E. L., Jr.
Valerius, Claude N.
- THROCKMORTON
Clowe, Charles E.
TYLER—Alexander, C. I.
Allen, Bryant W.
Bierman, Alfred C.
Bunn, John R.
Burford, Selwyn O.
Burnett, T. J.
Burton, George E.
Cardwell, D. Harold
Cash, Thornton C.
Denton, Frank Roy
Gunn, Delmar R.
Harden, Lynn L.
Howard, Edward L.
Hudnall, James S.
Loesterle, Gerald John
Matheny, H. Claire
Meholin, Graydon L.
Moore, Barton Walker
Murphy, Boyd Ferguson
Owen, Herman J.
Pirtle, George W.
Purcell, Paul E. M.
Robertson, Parker A.
Self, Seldon R.
Shelby, Thomas H., Jr.
Thomas, William T.
Trowbridge, Raymond M.
Umbach, Paul Henry
Wendlandt, Edward A.
Wilson, Edward B.
Wright, Andrew C.
Youngmeyer, Ray

MEMBERS

UVALDE—Getzendaner, Frank M.
 VANDERBILT
 Bauernschmidt, A. J., Jr.
 VAN HORN
 Gulmon, Gordon Wesley
 VICTORIA
 Johnston, Leslie Alexander
 WACO
 Blank, Horace Richard
 Manthos, Atlee G.
 Pool, Frank Morrow
 Smith, Fred E.
 WEATHERFORD—Smith, J. P.
 WESLACO—Christner, Harold R.
 WICHITA FALLS
 Autry, Vernon E.
 Bean, Ward C.
 Birk, Ralph A.
 Bowen, James P.
 Daniel, Orion A.
 Davies, Jack W.
 Davies, James Dudley
 Davis, John Roland
 Drake, Robert Tucker
 Engstrand, Clinton
 Fonville, Herman Albert
 Fowler, William James
 Gibbs, James F.
 Haseltine, William Lloyd
 Heninger, Dan D.
 Kay, John A.
 Kelly, Donald
 Kimball, Edgar W.
 Langford, David Kemp
 Martin, P. M.
 Maucini, Joseph J.
 McCoy, James Roy
 McGaha, Charles P.
 Moorhead, Johnny Bob
 Pettigrew, Virgil
 Petty, T. F.
 Richards, David Taylor
 Roth, Robert
 Russell, J. J., Jr.

Sanford, Wendell Glenn
 Scholl, Guy J.
 Setz, J. R.
 Shirr, Wilmer Ray
 Smiley, H. F.
 Stille, Earl M.
 Waggoner, Stephen Gose
 White, Albert William
 Wolverton, Harold A.
 YOAKUM—Wendenburg, Otto
 YORKTOWN—Johnson, Walter

UTAH

LOGAN—Williams, J. Stewart
 MILFORD—Severy, C. L.
 MOAB—Mayhew, Eldon Jay
 SALT LAKE CITY
 Bowen, Charles F.
 Whittier, William H.

VERMONT

STRAFFORD—Sohn, Israel G.

VIRGINIA

ALEXANDRIA—Hester, J. Ed
 Hoffer, Clarence W.
 Joujon-Roche, Jean Edward
 Porter, Phil
 ARLINGTON
 Couser, Chester Wendell
 Dumbros, Nicholas George
 Hughes, Richard V.
 Johnson, Edward William
 BLACKSBURG—Holden, Roy J.
 CHARLOTTESVILLE
 Cederstrom, Dagfin John
 McGill, William M.
 FALLS CHURCH
 Sherbondy, William Everett
 FORT BELVOIR
 Anderson, James Burt
 Monahan, Charles Joseph
 NORFOLK—Earle, Francis, Jr.

RICHMOND—Hawkins, Harold H.
 WARRENTON
 Buie, Bennett Frank

WASHINGTON

FORT LEWIS—Kotick, Ottmar F.
 GEIGER FIELD
 Bateman, Andrew Frank, Jr.
 OLYMPIA—Glover, Sheldon L.
 PULLMAN—Culver, Harold E.
 SEATTLE—Hunt, Leo Frank
 Knox, John K.
 Mitchell, Harold DeLong
 Umpleby, Joseph B.
 Weaver, Charles E.

SPOKANE
 Graham, Gordon Lloyd
 Sherman, Wilbur Brown

WEST VIRGINIA

CHARLESTON
 Anderson, Ray Ball
 Barney, Arthur Y.
 Billingsley, J. E.
 Brewer, Charles, Jr.
 Fisher, Otto
 Lafferty, Robert C., Jr.
 Simmons, Harvey Jefferson, Jr.
 Stanton, Edward Cramon, Jr.
 Ziebold, William O.
 CLARKSBURG
 Mayfield, William W.
 Tollefson, Everett H.
 LEWISBURG
 Argabrite, William Graeme
 MORGANTOWN
 Folsom, Lucas Wendell
 Galpin, Sidney L.
 Heck, Edward T.
 Hill, Robert Grant
 Price, Paul H.
 Reger, David B.
 Tucker, Rietz C.

PARKERSBURG
 Lilligen, Jonathan M.
 WHEELING—Hubman, Ralph G.

WISCONSIN

MADISON—Brossard, Eugene E.
 Frederickson, Edward A.
 Pyre, Augustin
 Twenhofel, W. H.
 PLATTEVILLE
 Morgan, Ray Earland

WYOMING

AFTON—Love, John David
 CASPER—Barrett, Albert F.
 Crawford, James Gilmore
 Gaul, George Howard
 Hares, C. J.
 Hubley, Myron D.
 Kampert, E. W.
 Larsen, Raymond M.
 Mallory, Robert William
 McCanne, Rolland W.
 Schoonmaker, George Russell
 Sielaff, Robert L.
 EVANSTON
 Bradbury, Albert Edward
 LABARGE
 Minton, Robert Joseph
 LANDER—Robbins, Luther S.
 LARAMIE—Beckwith, R. H.
 Espach, Ralph Homeward
 Knight, Wilbur Hall
 Thomas, Horace D.
 LOVELL—Neely, Joseph
 ROCK SPRINGS
 Dilger, Raymond Joseph
 Nightingale, W. T.
 SHERIDAN—Davis, John Harvey
 THERMOPOLIS
 Schwabrow, John R.
 TORRINGTON
 Robbins, Harold Weston

OUTSIDE UNITED STATES

ALBERTA

CALGARY
 Augenthaler, Robert Lewis
 Chilton, James Ryder
 Clark, Alexander
 Findlay, Willard Alexander
 Galloway, John O.
 Gray, John Gardiner
 Hancock, Willis Pritchard
 Hoover, Malvern Edward
 Howells, William Crompton
 Hunt, Edwin H.
 Hunter, Harry M.
 Irwin, J. S.
 Johnson, Russell V.
 Kirby, James M.
 Link, Theodore A.
 Lockwood, Robinson P.
 Perry, Bernard James
 Rea, Henry Carter
 Sanderson, James O. G.
 Slipper, S. E.
 Spratt, Joseph G.
 Steinkne, Max
 Thorne, B. L.
 Tovell, Walter Massey
 Williams, Thomas B.
 CARDSTON—Storm, Alfred E.
 EDMONTON—Allan, John Andrew
 Ball, Max W.
 Falconer, Wilbert Lawrence
 Mackenzie, William Donald
 Cossar
 TILLIE STATION—Gleddie, Joseph

ANGOLA

LOANDA—Roschen, Ernest C. H.

ARABIA

KUWAIT—Guntz, Henry Anthony
 Sass, Louis Carl

ARGENTINA

BUENOS AIRES
 Braccacini, Osvaldo I.
 Breitenstein, Robert S.
 Cook, Carroll E.
 Dessanti, Raul N.
 Ducious, Abel Herrero
 Fields, Harry B.
 Kundig, Ernest
 Leidhold, Clemens
 Martin, Rodolfo
 Reed, Lyman C.
 Rozlosnik, Andrews
 Severson, George A.
 Tarragona, Jose
 CRUBUT—Catlinari, Altavino E.
 LA PLATA
 Fossa-Mancini, Enrico
 Suro, Tomas
 MENDOZA—Feruglio, Egidio S.
 SALTA—Harrington, George L.
 VESFUCIO—Zunino, Juan Jose

AUSTRALIA

ASHTON PRAIRIE
 Mott, William Dick

BRISBANE
 Hutchison, Arthur Gilbertson
 Richards, Henry Caselli
 Wade, Arthur
 Walpole, Leonard Whitworth
 CANBERRA
 Raggatt, Harold George
 GORDON
 Woolnough, Walter George
 MELBOURNE
 Greenham, Roy Leonard
 Rudd, Eric A.
 PERTH—Moss, Frank A.
 SYDNEY—Carey, S. Warren
 Maddox, Walter H.
 Stanley, G. A. V.

AUSTRIA

LEOBEN—Petrasccheck, Wilhelm

BARBADOS

BRIDGETOWN—Senn, Alfred

BELGIAN CONGO

COSTERMANSVILLE
 Touwaide, Marcel E.

BOLIVIA

LA PAZ—Ekhom, Victor E.

BRAZIL

BAIA—Clayton, Edgar Hunter
 Pack, Oran L.

RIO DE JANEIRO
 Wyszynski, Otton W. T.

COLOMBIA

BARRANCA-BERMEJA
 Mulholland, Malcolm M.
 Sheldon, Robert Arnold
 BARRANQUILLA
 Chappell, Walter M.
 Colley, Bernard Belden
 de Escallón, Marion Roberta
 Durham, John Wyatt
 Garwood, Roland William
 Silva, Will

BOGOTA

Acosta-Sarmiento, Gonzalo
 Aitken, William Ernest
 Alvarado, Benjamin
 Andrews, Philip
 Bower, John O.
 Butler, John Weston, Jr.
 Dykstra, Bouwe
 Etherington, Thomas J.
 Fichter, Hans Jakob K.
 Graves, Allan Dexter
 Guerrero, Alberto Lobo
 Haanstra, Ulco
 Hatfield, Willis Charles
 Henry, Leonard W.
 Henry, Schuyler B.
 Lamon, Robert Scott
 McArthur, Donald
 Merritt, Roy W.
 Miley, Roy Allen

MEMBERS

401

Miller, John Bode
Miller, Robert P.
Oppenheim, Victor E.
Rigg, Robert M.
Saville, Charles William
Tabor, Lawrence L.
Tong, James A.
Trumpy, Daniel
Wheeler, Russell Benson
Whipple, G. Leslie
Wilson, Joe G.
CUCUTA—Bowler, James William
Hubman, Carl W.
Schoonover, Jack Gardner
EL CENTRO
Acheson, Cyrus Harold
Barrow, Geoffrey
Dallmus, Karl F.
VILLAVICENCIO
MacGregor, James Donald

COSTA RICA

SAN JOSE
Owian, James William
Link, Walter K.
Phillippi, William Harris, Jr.
Wallis, William E.

CUBA

HAVANA—Dohm, Christian F.
Gravell, Donald W.
Grimsdale, Thomas F.
Klecker, John Benedict
Palmer, Robert H.

DOMINICAN REPUBLIC

CIUDAD TRUJILLO
Bermudez, Pedro Joaquin
Eicher, Donald B.
Hunter, James W.

ECUADOR

GUAYAQUIL—Ayers, Floyd M.
Beuck, William Frederick
Durham, Charles Albert
Fournier, Frank Lawrence
Frizzell, Donald Leslie
Gallagher, John Patrick
Marks, Jay Glenn
Peterson, John Jean
Puttlitz, Fritz Helmuth
Smith, Lorne Alexander
Ward, Dwight Edward
QUITO—Dozy, Jean Jacques
Goldschmid, Karl Theodor
Kehrer, Louis
Parsons, Harold Ewing
Tschopp, Herman I.

EGYPT

CAIRO—Haight, Harold W.
Lytel, Harvey M.

ENGLAND

BERKS—Scott, Edwin Cooper
LONDON—Howard, Arthur Henry
Lees, George M.
Lepper, G. W.
Milner, Henry Brewer
Templeton, James Clark
Thompson, A. Beeby
MIDDLESEX—Hemmings, H.
Lovely, Herbert Richard
Taverne, N. J. M.
SURREY—Hunter, Campbell M.
Illing, Vincent Charles
TETBURY—Barker Maurice H. S.

FRANCE

HAUTE-GARONNE
Pomeyrol, Rene
VICNY
Damesin, Leopold C. F.

GERMANY

BERLIN—Stille, Hans
WIEN—Burgi, Hans

HAITI

PORT-AU-PRINCE
Kirk, Howard M.
Weidmann, Carl

HAWAII

OAHU—Seals, Wilburn Hall

INDIA

BOMBAY—DANIEL, Edgar James
LAHORE—Lehner, Ernest J.

IRAN

TEHERAN
Karubian, Ruhollah Y.

IRAQ

BASRAH—Hotchkiss, Henry
KIRKUK—Henson, F. K. S.

ITALY

PARMA—Wiedenmayer, Carl

JAPAN

TOKYO—Iki, Tsunenaka
Uwatoki, Junio

JAVA

BATAVIA
Brouwer, Luitzen Egbertus Jan
Nelson, Richard N.

LIBAN

BEYROUTH—Birembaut, Arthur

MEXICO

COATZACOALCOS
Vázquez, Andrés López
MEXICO CITY
Alvarez, Manuel, Jr.
Arellano, A. R. V.
Burbridge, Charles E., Jr.
Garñas, Valentine R.
Ordóñez, Ezequiel
Storm, Lynn W.
MONTERREY—Cassel, Chester
Martínez, Fidel Castilla
SANTILLO—Kane, William G.
TACUBAYA—Millerried, F. K. G.

NETHERLANDS

BERGEN
van der Gracht, W. A. J. M.
THE HAGUE—van Gogh, F. A. A.

NEW BRUNSWICK

FREDERICTON
Wright, William Joseiah
MONCTON—Hole, Herbert Wray

NEW ZEALAND

CHRISTCHURCH
Collins, Burton Wallace
GISBORNE—Barnwell, George F.
Weymouth, A. Allen
NEW PLYMOUTH
Bossard, Leon
Steiner, Bruce Harry
PALMERSTON
Feldmeyer, Arthur E.
Nicholas, Norval W.
WELLINGTON—Morgan, D. E.
Ongley, Montague

NICARAGUA

MANAGUA
Fagginger-Auer, Willem A.

ONTARIO

OTTAWA
Beach, Hugh Hamilton

Hume, George S.
TORONTO—Berswick, James D.
Hopkins, Oliver B.
McNaughton, Duncan Anderson
Wheeler, Orby Clinton

PALESTINE

HAIFA—Browne, Richard Vernon
JERUSALEM—Wellings, Frank E.

PANAMA CANAL ZONE

DIABLO HEIGHTS
Garber, Marshall West
Hilton, Willard Ordway

PAPUA

PORT MORESBY
Edwards, Allan Kingswood
Morgan
Gray, E. Washington

PERSIAN GULF

BAHREIN ISLAND
Barger, Thomas Charles
Brankamp, Richard Allen
Langham, Noel Thomas

PERU

LIMA—Fyfe, Douglas
Iddings, Arthur
Jenks, William Furness
Mackenzie, Andrew N.
Newell, Norman Dennis
NEGRITOS—Bell, A. Lyndon

PHILIPPINE ISLANDS

CAVITE—Mortlock, Frank O.
MANTILA—Bain, H. Foster
Corby, Grant W.
Newman, George Hawkins

PORTUGAL

LISBON—Mendelsohn, Clive A.

ROUMANIA

BUCHAREST
Voitești, Ion Popescu
PLOESTI—Hlauschek, Hans

SASKATCHEWAN

MOOSE JAW
Sproule, John Campbell

SCOTLAND

EDINBURGH
Brown, James Chapman
PITTENWEEM FIFE
Williamson, Thomas F.

SUMATRA

MEDAN—Paap, Antonie
PALEMBANG—Bard, Richards J.
PANGKALAN BRANDAN
Koch, Richard E.

SWITZERLAND

AARGAU—Gutzwiller, Otto
BASEL—Bernoulli, W.
Braendlin, Emil
Erni, Arthur
Keller, Walter T.
Ritter, Ernest A.
Staeppelin, Peter Karl
Vonderschmitt, Louis
LAUSANNE—Gagnebin, Elie A.
NEUCHÂTEL
Wasserfallen, Bernard

ZURICH
Frischnecht, Gustav

THAILAND

DHONBURI
Sresthaputra, Vija

TRINIDAD

FOREST RESERVE
Payne, Arthur Lawrence
Young, Raymond Owen
FYZABAD—Baker, Thomas Henry
GUAYAGUAYARE
Guimond, Stanislas de Kostka
PALO SECO

Wilson, Cedric Clarke
POINTE-A-PIERRE

Barr, Kenneth William
Caudri, Cornelle Marguerite B.
Griffiths, John Cedric
Higgins, George Esmond
Hoenshell, David T.
Jowett, Maurice Wilson
Kugler, Hans G.
Renz, Hans Herman
Rogers, Harry Samuel
Rohr, Karl
Stainforth, Robert Masterman
Suter, Hans H.
Thomas, Hallowell Charles H.

POINT FORTIN

Baggelaar, Hermanus
Waite, Stephen Temple
SAN FERNANDO
Boutakoff, Nicholas
Penny, Frederick W.
SEFARIA—Scott, Gerald Hugh

TURKEY

ANKARA—Tasman, Cevat E.

URUGUAY

MONTEVIDEO
Vercesi, Daniel Rey

VENEZUELA

BARCELONA
Fowler, Charles W., Jr.
Funkhouser, Harold John
Hedberg, Hollis D.
Johnson, Frank Walker
Lockett, George L.
Manger, G. Edward
Mason, John Frederick
Rincones, Carlos Antonio V.
CARACAS—Aguerrevere, Pedro I.
Aguerrevere, Santiago E.
Baird, Chester A.
Boylan, Ebert E.
Bray, Vinton Arthur
Conrad, Peter Paul
Crebbs, Chester M.
Davis, Irion Grady
de Juana, Clemente Gonzalez
Floyd, Florin W.
Gordes, Carl Herman
Judson, Jack Finlay
Kaufmann, Godfrey E.
Kaye, M. Kamen
Kerstetter, Dale David
Lee, Clarence L.
LeRoy, Frank Leon
Martin, Francis I.
Mix, Adrian Eloy
Nolan, Philip Edward
Notestein, Frank B.
Perkinson, Floyd
Poulin, John A.
Rivero, Manuel
Sherman, Roger H.
Tipsword, Howard Lee
Weisbord, Norman E.
West, Donald M.
Wilson, Thomas C.
Zalkowski, Michael Wladimir
Zuloaga, Guillermo

CARIPITO

Ackerman, Edgar Dumont
Beckmann, Lawrence J.
Borger, Harvey D.
Loeffler, Richard John
Martin, Bethae Allen
Regan, John H.
Sorrells, Warren Douglas

MEMBERS

Tuohy, John D.
Winkler, Virgil Dean
ESTADO GUARICO
Evanoff, John
LAGUNILLAS—Dickinson, George
MARACAIBO—Allen, John O.

Dawson, Herbert Marion
Douglas, John G.
Freie, A. J.
Hegwein, Walter H.
Jopling, Don Winter
Martin, Rudolf

Nash, Howard F.
Netick, Joe
Pintea, Michael, Jr.
Pospisil, Frank J.
Ratway, Joseph
Sawyer, Joseph Herbert

Schaub, Hans Peter
Stiles, Aden Edmund
Sutton, Frederick A.
Tapp, Theodore Leland
MATURIN
Moore, Bernard Nettleton

FINANCIAL STATEMENT FOR THE YEAR 1942

To the Executive Committee,
The American Association of Petroleum Geologists.

In continuation of our examinations in prior years we have examined the accounting records of THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS for the year ended December 31, 1942, and now present our report together with the following statements:

Exhibit

- A Statement of Financial Condition, December 31, 1942
- B Statement of Income for the year ended December 31, 1942

Schedule

- *1 Statement of Investments, December 31, 1942
- 2 Statement of Income from Publications for the year ended December 31, 1942
- 3 Statement of General and Administrative Expenses for the year ended December 31, 1942

In connection with our examination, we reviewed the system of internal control and the accounting procedures of the Association and, without making a detailed audit of the transactions, have examined or tested accounting records of the Association and other supporting evidence, by methods and to the extent we deemed appropriate. Our examination was made in accordance with generally accepted auditing standards applicable in the circumstances and included all procedures which we considered necessary.

Publications on hand at December 31, 1942, were priced as follows: 1942 publications at cost; 1941 and prior years' publications at appraised values and a reserve provided for excessive quantities and old numbers, in accordance with a resolution adopted by the Executive Committee January 1, 1932.

Confirmation of certificates of securities in the custody of The New York Trust Company at December 31, 1942, was received directly from the custodian.

In our opinion, the accompanying statement of financial condition and related statement of income, supplemented by the supporting schedules, present fairly the position of THE AMERICAN ASSOCIATION OF PETROLEUM GEOLOGISTS at December 31, 1942, and the results of its operations for the year in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

(Signed) ARTHUR YOUNG & COMPANY, *Accountants and Auditors*

TULSA, OKLAHOMA
February 3, 1943

* Schedule 1 is not here published.

EXHIBIT A

STATEMENT OF FINANCIAL CONDITION DECEMBER 31, 1942

ASSETS		Total	General Fund	Publication Fund	Research Fund
CURRENT ASSETS:					
Demand deposits—					
The First National Bank and Trust Company, Tulsa, Oklahoma...	\$ 20,669.78	\$14,259.78	\$ 6,130.14	\$ 279.86	
National Bank of Commerce, Tulsa, Oklahoma	662.82	662.82	—	—	
TOTAL DEMAND DEPOSITS	\$ 21,332.60	\$14,922.60	\$ 6,130.14	\$ 279.86	
Accounts receivable—					
Membership dues less reserve of \$936.00	\$ 936.00	\$ 936.00	—	—	\$ —
Advertising	1,157.25	1,157.25	—	—	—
Amount due from The New York Trust Company	667.49	497.24	170.25	—	—
Other accounts receivable less reserve of \$452.84	125.53	74.93	50.60	—	—
TOTAL ACCOUNTS RECEIVABLE ..	\$ 2,886.27	\$ 2,665.42	\$ 220.85	\$ —	\$ —
Accrued interest receivable less reserve of \$575.41	\$ 315.31	\$ 239.30	\$ 51.01	\$ 25.00	\$ —
Inventory of publications less reserve of \$21,992.38 (see report)	\$ 20,477.82	\$10,500.10	\$ 9,977.72	\$ —	\$ —
TOTAL CURRENT ASSETS	\$ 45,012.00	\$28,327.42	\$16,379.72	\$ 304.86	\$ —
INVESTMENTS at market which is \$7,182.22 less than cost					
	\$ 74,247.41	\$56,717.53	\$15,194.18	\$2,335.70	\$ —
FURNITURE AND FIXTURES less reserve of \$4,194.76	\$ 1.00	1.00	—	—	\$ —
DEFERRED CHARGES:					
Printing in progress	\$ 368.16	\$ 368.16	—	—	\$ —
Other deferred charges	127.34	94.34	33.00	—	—
TOTAL DEFERRED CHARGES	\$ 495.50	\$ 462.50	\$ 33.00	\$ —	\$ —
TOTAL ASSETS	\$119,755.91	\$85,508.45	\$31,600.90	\$2,640.56	\$ —
LIABILITIES AND SURPLUS					
CURRENT LIABILITIES:					
Accounts payable	\$ 1,607.52	\$ 1,607.52	\$ —	\$ —	\$ —
Accrued liabilities—					
Accrued printer's charges	368.16	368.16	—	—	—
Accrued taxes	83.41	83.41	—	—	—
TOTAL CURRENT LIABILITIES	\$ 2,059.09	\$ 2,059.09	\$ —	\$ —	\$ —
DEFERRED INCOME:					
Memberships and subscriptions—					
Active memberships	\$ 7,541.84	\$ 7,541.84	\$ —	\$ —	\$ —
Associate memberships	1,343.80	1,343.80	—	—	—
Subscriptions to Bulletin	2,272.20	2,272.20	—	—	—
Advertising	\$ 11,157.84	\$11,157.84	\$ —	\$ —	\$ —
	502.25	502.25	—	—	—
TOTAL DEFERRED INCOME	\$ 11,660.09	\$11,660.09	\$ —	\$ —	\$ —
SURPLUS:					
Balance, December 31, 1941	\$100,554.46	\$67,441.92	\$30,354.83	\$2,757.71	\$ —
Net income—loss for the year ended December 31, 1942	5,482.27	4,347.35	1,252.07	—117.15	—
Balance, December 31, 1942	\$106,036.73	\$71,789.27	\$31,606.90	\$2,640.56	\$ —
CONTINGENT LIABILITIES:					
All known liabilities of the Association at December 31, 1942 were recorded in the accounts and no litigation was pending at that date.					
TOTAL LIABILITIES AND SURPLUS	\$119,755.91	\$85,508.45	\$31,600.90	\$2,640.56	\$ —

SUBJECT TO COMMENTS IN ACCOMPANYING REPORT

SCHEDULE 2—STATEMENT OF INCOME FROM PUBLICATIONS FOR THE YEAR ENDED DECEMBER 31, 1942

	Total	General Fund	Publication Fund
OPERATING INCOME:			
Dues transferred.....	\$22,926.00	\$22,926.00	\$ —
Bulletin subscriptions.....	3,937.22	3,937.22	—
Advertising—net.....	8,168.10	8,168.10	—
Sales of bound volumes and special publications—			
Bound volumes of Bulletin.....	\$ 2,152.90	\$ 2,152.90	\$ —
Back numbers of Bulletin.....	556.99	556.99	—
Possible Future Oil Provinces of the United States and Canada.....	571.23	571.23	—
Permian of West Texas and Southeastern New Mexico.....	257.45	257.45	—
Origin of Oil.....	312.00	312.00	—
Symposium on Petroleum Discovery Methods.....	573.00	573.00	—
Report of a Conference on Sedimentation.....	240.00	240.00	—
Stratigraphic Type Oil Fields.....	3,504.93	—	3,504.93
Source Beds of Petroleum.....	1,746.65	—	1,746.65
Geology of Natural Gas.....	372.60	—	372.60
Gulf Coast Oil Fields.....	245.60	—	245.60
Geology of the Tampico Region.....	146.35	—	146.35
Miocene Stratigraphy of California.....	138.10	—	138.10
Recent Marine Sediments.....	105.10	—	105.10
Tectonic Map of Southern California.....	21.85	—	21.85
Regional Cross Sections.....	27.10	27.10	—
Other publications.....	147.44	147.44	—
TOTAL INCOME.....	11,110.29	4,838.11	6,281.18
COSTS AND EXPENSES:	\$46,150.61	\$39,869.43	\$6,281.18
Proportion of manager's salary.....	\$ 3,750.00	\$ 3,750.00	—
Editorial salaries.....	4,013.23	4,013.23	—
Printing Bulletins.....	17,753.64	17,753.64	—
Engraving.....	2,449.49	2,449.49	—
Special insert charges.....	350.88	350.88	—
Stencil corrections and mailing.....	252.81	252.81	—
Bulletin mailing and express.....	977.98	977.98	—
Copyright fees.....	24.00	24.00	—
Reprints.....	455.91	455.91	—
Binding Volume XXV.....	578.62	578.62	—
Translating Regional Cross Sections.....	15.73	15.73	—
Cost of printing Permian of West Texas and Southeastern New Mexico.....	396.85	396.85	—
Cost of printing Symposium on Petroleum Discovery Methods.....	1,044.47	1,044.47	—
Cost of printing Report of a Conference on Sedimentation.....	313.54	313.54	—
Cost of printing Origin of Oil.....	155.04	155.04	—
Cost of printing Stratigraphic Type Oil Fields.....	6,933.52	—	6,933.52
Cost of printing Source Beds of Petroleum.....	3,753.73	—	3,753.73
Other publications—freight, express and postage.....	188.71	—	188.71
Miscellaneous.....	62.86	44.95	17.91
Less: Inventory increase.....	\$43,471.01	\$32,577.14	\$10,893.87
	6,227.93	1,205.14	4,902.79
TOTAL COSTS AND EXPENSES.....	37,243.08	31,312.00	5,931.08
NET INCOME FROM PUBLICATIONS.....	\$ 8,907.53	\$ 8,557.43	\$ 350.10

SUBJECT TO COMMENTS IN ACCOMPANYING REPORT

THE ASSOCIATION ROUND TABLE

407

SCHEDULE 3

STATEMENT OF GENERAL AND ADMINISTRATIVE EXPENSES FOR
THE YEAR ENDED DECEMBER 31, 1942

GENERAL FUND:

Proportion of manager's salary	\$ 3,750.00
Clerical salaries	5,104.80
Payroll taxes for the years 1936 to 1942 (including interest and penalties of \$815.42) ..	4,448.87
Postage	1,812.98
Office rent	1,620.00
Office supplies and expenses	394.16
Telephone and telegraph	367.27
Printing and stationery	405.64
Freight and express	229.38
Insurance	237.11
Audit fee	300.00
Investment counsel	400.00
Traveling expenses	140.09
Depreciation	53.35
Bad debts	922.50
Distinguished Lecture Committee expense	500.00
National Service Committee expense	652.26
Miscellaneous	294.96

\$21,633.37

PUBLICATION FUND:

Miscellaneous	\$ 37.50
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TOTAL GENERAL AND ADMINISTRATIVE EXPENSES

\$21,670.87

SUBJECT TO COMMENTS IN ACCOMPANYING REPORT

THE ASSOCIATION ROUND TABLE

FINANCIAL STATEMENT, DIVISION OF PALEONTOLOGY
AND MINERALOGY, FOR THE YEAR 1942

To the Council,
Society of Economic Paleontologists and Mineralogists.

In continuation of our examinations in prior years we have examined the accounting records of the SOCIETY OF ECONOMIC PALEONTOLOGISTS AND MINERALOGISTS for the year ended December 31, 1942, and now present our report together with the following statements:

Exhibit

- A Statement of Financial Condition, December 31, 1942
- B Statement of Income for the year ended December 31, 1942

Schedule

- I Statement of Receipts and Disbursements for the year ended December 31, 1942

In connection with our examination, we reviewed the system of internal control and the accounting procedures of the Society and, without making a detailed audit of the transactions, have examined or tested accounting records of the Society and other supporting evidence, by methods and to the extent we deemed appropriate. Our examination was made in accordance with generally accepted auditing standards applicable in the circumstances and included all procedures which we considered necessary.

Inventory of publications represents approximately 28,900 Journals (exclusive of Journals in excess of complete sets for issues prior to 1942) including certain issues printed at the expense of the Paleontological Society for the years 1935 to 1942, inclusive, stated at appraised values of fifty cents each for Journals printed prior to 1942 or cost to either the SOCIETY OF ECONOMIC PALEONTOLOGISTS AND MINERALOGISTS or the PALEONTOLOGICAL SOCIETY for Journals printed in 1942. The SOCIETY OF ECONOMIC PALEONTOLOGISTS AND MINERALOGISTS has agreed to distribute a portion of its income to the Paleontological Society; the amount accruing to the latter for the year 1942 amounted to \$336.80.

In our opinion the accompanying statement of financial condition and related statement of income present fairly the position of the SOCIETY OF ECONOMIC PALEONTOLOGISTS AND MINERALOGISTS at December 31, 1942, and the results of its operations for the year, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

(Signed) ARTHUR YOUNG & COMPANY, *Accountants and Auditors*

TULSA, OKLAHOMA
February 1, 1943

THE ASSOCIATION ROUND TABLE

409

EXHIBIT A

STATEMENT OF FINANCIAL CONDITION, DECEMBER 31, 1942

ASSETS

CURRENT ASSETS:

Demand deposits—

The First National Bank and Trust Company, Tulsa, Oklahoma....	\$2,423.06	
National Bank of Commerce, Tulsa, Oklahoma.....	138.70	\$ 2,561.76

Savings deposit—

The First National Bank and Trust Company, Tulsa, Oklahoma....		2,187.59
--	--	----------

Accounts receivable—

Printed matter less reserve of \$84.00.....	\$ 37.20	
Other.....	21.47	58.67

TOTAL CURRENT ASSETS.....

\$ 4,808.02

INVENTORY OF PUBLICATIONS—see report.....

15,770.51

FURNITURE AND FIXTURES.....

\$ 482.60

Less: Reserve for depreciation.....	240.72	241.88
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TOTAL ASSETS.....

\$20,820.41

LIABILITIES AND SURPLUS

CURRENT LIABILITIES:

Accounts payable.....	\$ 271.86
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Accrued taxes.....	9.31
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Amount due to Paleontological Society.....	336.80
--	--------

TOTAL CURRENT LIABILITIES.....

\$ 617.97

DEFERRED INCOME:

Subscriptions to Journals.....	\$1,089.50
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Membership dues for 1943 and 1944.....	641.66	1,731.16
--	--------	----------

SURPLUS

Balance, December 31, 1941.....	\$18,368.68
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Net income for the year ended December 31, 1942 (Exhibit B).....	102.60
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Balance, December 31, 1942.....	18,471.28
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TOTAL LIABILITIES AND SURPLUS.....

\$20,820.41

SUBJECT TO COMMENTS IN ACCOMPANYING REPORT

THE ASSOCIATION ROUND TABLE

EXHIBIT B

STATEMENT OF INCOME FOR THE YEAR ENDED DECEMBER 31, 1942

OPERATING INCOME:

Dues and subscriptions—

Journal of Paleontology and Sedimentary Petrology.....	\$ 752.00	
Journal of Paleontology.....	2,586.50	
Journal of Sedimentary Petrology.....	776.10	

\$4,114.60

Sales of back numbers—

Journal of Paleontology.....	\$ 672.20	
Journal of Sedimentary Petrology.....	182.50	854.70

Sales of plates and reprints.....

300.76

Advertising.....

62.46\$5,332.52

Less: Proportion of income accrued to Paleontological Society.....

336.80\$4,995.72

COSTS AND EXPENSES:

Cost of printing—

Journal of Paleontology.....	\$4,006.87	
Journal of Sedimentary Petrology.....	980.37	

\$4,987.24

Clerical salaries.....

756.00

Office rent.....

300.00

Postage and mailing.....

239.90

Audit fee.....

100.00

Office supplies and expenses.....

79.14

Depreciation.....

48.26

Taxes.....

26.18

Other costs and expenses.....

109.50\$6,646.22

Less: Increase in inventory of publications.....

1,688.89

4,957.33

\$ 38.39

NON-OPERATING INCOME:

Recovery of accounts previously charged off.....

\$ 28.00

Interest on savings deposit.....

21.71

Miscellaneous.....

14.50

64.21

NET INCOME.....

\$ 102.60

SUBJECT TO COMMENTS IN ACCOMPANYING REPORT

THE ASSOCIATION ROUND TABLE

411

SCHEDULE 1

STATEMENT OF RECEIPTS AND DISBURSEMENTS FOR THE YEAR ENDED DECEMBER 31, 1942

DEMAND DEPOSITS, DECEMBER 31, 1941..... \$4,304.30

RECEIPTS:

Membership dues and subscriptions—

Year 1942—

Journal of Paleontology and Sedimentary Petrology...	\$ 760.00	
Journal of Paleontology.....	1,291.50	
Journal of Sedimentary Petrology.....	415.60	\$2,467.10

Years 1943, 1944 and 1945—

Journal of Paleontology.....	\$ 977.60	
Journal of Sedimentary Petrology.....	317.10	1,294.70

Sales of back numbers—

Journal of Paleontology.....	\$ 506.60	
Journal of Sedimentary Petrology.....	123.85	630.45

Sales of plates and reprints.....		305.48
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Accounts receivable.....		186.53
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Miscellaneous.....		543.53	5,427.79
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\$9,732.09

DISBURSEMENTS:

Printing expenses—

Journal of Paleontology.....	\$2,837.87	
Journal of Sedimentary Petrology.....	650.01	
Engraving Journal of Paleontology.....	1,109.68	\$4,597.56

Postage and mailing.....		125.14
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Office rent.....		300.00
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Clerical salaries.....		684.90
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Audit fee.....		100.00
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Payment to Paleontological Society.....		358.38
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Editorial salaries.....		365.34
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Accounts payable.....		325.34
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Taxes.....		28.99
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Refunds on subscriptions.....		100.40
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Office supplies and expenses.....		9.75
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Miscellaneous.....	174.53	7,170.33
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DEMAND DEPOSITS, DECEMBER 31, 1942..... \$2,561.76

SUBJECT TO COMMENTS IN ACCOMPANYING REPORT

THE ASSOCIATION ROUND TABLE

MEMORANDUM OF NATIONAL SERVICE COMMITTEE¹

F. L. AURIN²
Fort Worth, Texas

In order to keep the National Service Committee and the membership of the A.A.P.G. and affiliated societies informed on recent events and happenings affecting the petroleum industry and directly or indirectly the petroleum geologist, the following news items should be of interest to all concerned.

EXCERPTS FROM REPORT OF SPECIAL SUBCOMMITTEE ON PETROLEUM INVESTIGATION
OF INTERSTATE AND FOREIGN COMMERCE COMMITTEE OF HOUSE OF
REPRESENTATIVES, DATED DECEMBER 31, 1942

"PRODUCTION

"Now, from wasteful production, and surpluses, we turn to economies of production, conservation, and a concern for maintaining our supply.

"Peacetime demands increased constantly. Military needs and war activities have accentuated the demand.

The oil crop does not reproduce. From every field we are consuming a nonrestorable supply. The maintenance of a balance production and supply requires new discoveries equal to current consumption.

"That the zenith of our capacity to meet requirements from domestic production has been passed is revealed by—

"The declining rate in the number of new fields found each year.

"The decrease each year in the number of barrels of oil recoverable per field discovered.

"The dwindling capacity of producing wells to meet consumptive demand, or, without wasteful dissipation of underground reserves, to increase present productive rates.

"We have a dwindling domestic area potentially capable of producing oil.

"Inadequate provision for conservation of present developed reserves through secondary recovery methods.

"The discovery of new reserves of petroleum has been declining rapidly since 1939. We now use about 1.4 billion barrels of oil per year, yet discoveries since the beginning of 1939 have been at the rate of only about half the consumption rate.

"The low rate of discovery is not the result of slackening exploratory effort. Rather it is due in large part, to the diminishing size of the pools found. In other words, the drilling of the same number of wildcat wells as heretofore discovers a far less amount of new reserves.

"The volume of exploratory drilling in 1939, 1940, 1941, was about thirty per cent greater than during the preceding three-year period.

"In view of the increasing war consumption of petroleum and the fact the war plans must provide for two or three years in advance, it is imperative that additional reserves be discovered to assure that production will meet war demands.

"Naturally, oil production has been from the most conveniently known sources. New discoveries must be anticipated in deeper stratas or in other more difficult locations and likely in smaller quantities. This situation portends greater difficulties of production and increased cost as well as greater delay.

"New and better oil-finding techniques are needed as well as the improvement of the present ones. More wildcat wells are needed than ever before.

"Continued development of new fields and those not yet fully drilled is urgently needed. The continuation of this policy rather than the more intensified development of fields already adequately drilled, will more nearly provide the productive capacity to meet war requirements and with limited quantities of steel.

"HANDICAPS TO PRODUCTION

"Serious losses of technical and skilled personnel to the armed services and to the competitive labor market have seriously handicapped oil production.

"SUPPLYING THE NEED

"The average demand for crude oil supplied at the wells per day during seven months of this year were 4,110,000 barrels. The production during that period averaged 3,870,000 barrels or 240,000 barrels per day less than consumption. The projected demands for the year 1943 are increasingly

¹ Manuscript received, February 22, 1943.

² Chairman, A.A.P.G. National Service Committee.

and greatly in excess of estimated production. In the meantime, during the last eight months our stored supplies of crude and petroleum products have declined 60,000,000 barrels.

"In the face of these declining reserves, we have several outstanding facts. One is the long delay that has ordinarily occurred in peacetime between discovery and quantity production of oil wells. As indicated elsewhere in this report, according to the average record of the past, only a little over one per cent of the production annually available from a well is realized the first succeeding year, 5.8 per cent the second year, and only 8.11 per cent during the third year.

"The time elapsing between discoveries and quantity productions must be substantially reduced if discoveries hereafter made are to contribute substantially to the war supply of petroleum and petroleum products.

"The first and most dependable source of meeting this increased demand is domestic production.

"As sources of increased domestic supply we must look to our known wells and reserves for increased production, to development of new sources and the better use of stripper and declining wells.

"Overcrowding our domestic production can be nothing more than a temporary wasteful and improvident method for increasing production. Such methods of production can temporarily expand the supply but lead to premature exhaustion and ultimately to decreased production with the resulting economic waste for the future. The losses from overcrowding production are not inconsequential, but may well amount to a substantial part of our present oil reserves. This situation demands aggressive support of wildcatting, discoveries, and new production.

"The service of no man is comparable to that of the man who offers his life in support of his country. The man who engages in essential production for war purposes makes a contribution that may be equally necessary to win the war but whose services can hardly rate with that of the man who offers his life for the country.

"In the face of abundant supplies of petroleum products we have long enjoyed a full supply for peacetime needs. Our country is quite unconscious of the possible shortage of petroleum products that may face the Nation within the next year. We still have vast quantities of oil. We have the oil shales, great beds of coal and vegetable materials which can afford substitutes for gasoline in the long-time future. But now we face an abnormal demand which can be met providently only by positive aggressive action without delay and controlled by experienced men.

"MUST BALANCE CIVILIAN AND WAR ACTIVITIES

"In waging this war we have our economic machine and our military machine. These two machines when synchronized and balanced, represent the war strength of America. The highest degree of efficiency of this Nation in waging war will be accomplished when these two machines are perfectly balanced, synchronized, and harmonized in this effort.

"The number and operation of practically all our military equipment is limited by the supply of petroleum products which can be delivered to the point of use. The number of men that can be effectively used is no greater than can be trained, transported, supplied, and equipped. The number of men for our military operations is limited by our supply of oil, our refining capacity, and our transportation.

"The effectiveness of our Army during the rest of this war is going to be determined on how thoroughly and comprehensively our manpower, our civilian activities in support of the war, war personnel, and equipment can be balanced.

"As to petroleum, we have the choice of increasing our production or decreasing our military plans to conform to our oil supplies. This fact simply illustrates the importance of positive aggressive action to increase our oil supplies."

"CONCLUSIONS AND COMMENTS

"Materials and manpower.—It is recommended that, within the proper sphere of governmental functions, every possible opportunity and incentive should be extended for the maintenance and increase of domestic production including the allocation of materials and manpower required for development, production, and secondary recovery projects.

"Development and production.—The development and production of the Nation's present petroleum reserves—plus such new reserves as are found—must proceed upon such basis as will insure the maintenance of the productive capacity of the Nation throughout the war. Now, more than ever before, it is imperative that we guard our reserves by all methods consistent with necessary production."

JOINT STATEMENT PAUL V. McNUTT, CHAIRMAN OF WAR MANPOWER COMMISSION,
AND HAROLD L. ICKES, PETROLEUM ADMINISTRATOR FOR WAR, FEBRUARY 2, 1943

"REPORTS are being received in Washington from a few places to the effect that oil-company employees misunderstood the War Manpower Commissions' recent statement about non-deferrable occupations.

"THE reports are that oil, natural gas and gasoline company employees engaged in vital and essential jobs in that industry failed to report for work and instead were seeking employment in munitions plants or some other kind of work which they thought was listed as more essential by the War Manpower Commission.

"PETROLEUM is regarded as one of the most essential of war industries and has been so designated previously by the War Manpower Commission. Bulletins issued by the WMC to local United States Employment Services offices, and Selective Service Occupational Bulletins Nos. 15 and 21, issued in August and September, 1942, for the guidance of local draft boards and of employers, list 179 specific classes of jobs in the petroleum and natural gas industry and its transportation service which are directly classed as essential activities.

"OIL and natural gas are vital to this war and it does not help to win the war for men who have long been trained and skilled in this industry to leave their present jobs. We wish to emphasize that while planes, tanks, and ships fight the battles, they cannot fight without oil to fuel them. The production, refining, transportation, and distribution of oil and gas are all necessary.

"THE same principle applies to other essential industries and to the countless services of civilian supply. Any man who reads the limited list of activities covered by the recent WMC order will see that it is merely directed at things which either (a) can be done without for the duration of the war, or (b) can be performed by women, older or handicapped workers, or by unskilled workers.

"AN ORDER which was intended to apply to such things as ornamental glass, costume jewelry, or greeting cards does not carry any implication for such vital industries as oil, mining, food processing and other essential industries which wartime America must keep fully manned.

"EMPLOYERS and workers who want information on the essentiality of the work they are engaged in should consult their nearest local United States Employment Service Office."

PETROLEUM INDUSTRY WAR COUNCIL'S REPORT ON SUGGESTIONS ON LABOR SHORTAGES

The P.I.W.C. Committee on Manpower is composed of John M. Lovejoy, chairman; Sidney Belither; J. W. Carnes; N. C. McGowen; and J. Howard Pew. J. L. Dwyer is secretary. The objective of this committee was to make a study of the manpower situation in the petroleum industry and to not only report on conditions, but, in addition thereto, to recommend or make suggestions on overcoming labor shortages, if such existed. Briefly, this committee concluded that, in general, the loss of manpower has not seriously affected the ability of the oil industry to function efficiently in practically all spheres of activity *with the exception of having difficulty in the replacements and shortages of technical men.*

SUGGESTIONS BY P.I.W.C. COMMITTEE ON MANPOWER PROBLEMS

1. Establishment of a company employment pool.
2. Employment of women and older men, with examples of the types of oil-company jobs that women can fill.
3. Investigate the possibility of increasing the use of non-white employees.
4. Cease retiring employees who still are able to perform a job.
5. Search lists of former employees over 38 now in the armed forces, who may wish to return to your company under the provisions of recent regulations.
6. Do not attempt to persuade local draft boards to defer every employee. Use form 42-A for key men and those in critical jobs only.
7. Encourage present employees to find new employees among relatives and friends.
8. Look for new employees among wives of young married men going into service.
9. Relax any rules that women who marry must resign.
10. Relax physical requirements to employ physically handicapped people for certain jobs.
11. Use the Manning tables developed by the War Manpower Commission.
12. Exhaust all possibilities of upgrading, job-breakdown, and inplant training.
13. Use every effort to obtain deferment for professional personnel, but do not overlook the possibility of women for some jobs such as laboratory assistants.
14. Smaller companies and individual operators should adopt similar policies modified to fit their size, planning in advance for the replacement of employees.

REMARKS BY NATIONAL SERVICE COMMITTEE ON MANPOWER SITUATION

The National Service Committee has furnished this committee with an estimate of the number of petroleum geologists in the Armed Forces and in civilian capacities with Governmental agencies. The following is quoted from our report (December 18, 1942) to the P.I.W.C. Committee on Manpower.

"For your information, there are normally about 3500 petroleum geologists in the United States. Most of these are members of the A.A.P.G. We have made some recent estimates on the manpower situation with respect to the petroleum geologist, and the following information may be of interest to you:

"A.A.P.G. members in military service	400
Petroleum geologists, non-members A.A.P.G. (in military service)	100
A.A.P.G. members in civilian capacities with Governmental agencies directly connected with the War Effort	150

"A total of 650 in military and civilian capacities with the Government and Allied Nations.

"The above estimates do not take into account many members of the A.A.P.G. who are working for State geological surveys and in work mostly connected with the War Effort.

"The above estimates do not take into account many geophysicists who are not members of the A.A.P.G. The total membership of the A.A.P.G. is approximately 4,000 which, of course, includes a substantial number of geologists engaged in foreign work, and foreign members. We have been reliably informed that some of the large companies have lost as much as 40 per cent of their personnel in the geological departments."

Since the foregoing information was furnished the P.I.W.C. Committee, our revised estimates of the number of members in the Armed Forces and in civilian capacities with Government agencies are as follows.

A.A.P.G. members in military service	500
Petroleum geologists, non-members A.A.P.G. (in military service)	100
A.A.P.G. members in civilian capacities with Government agencies	175
A total of 775 in military and civilian capacities with the Government and Allied Nations.	

There is a definite shortage of manpower in the geological departments of both major and independent oil companies. This fact is clearly set out by the many recent inquiries or requests for petroleum geologists.

IMPORTANCE OF PETROLEUM GEOLOGISTS MENTIONED ON RADIO PROGRAM

There has been such slight recognition by the public in general, many officials, and draft boards of the work of the petroleum geologist and geophysicist in the War Effort, that the following broadcast of The Pure Oil Company is a very welcome statement.

THE PURE OIL COMPANY—H. V. Kaltenborn

Tuesday, January 19, 1943—NBC #3

ANNOUNCER:

"The Pure Oil Company presents—H. V. Kaltenborn, dean of American news commentators! Modern war is waged with *oil*—oil for fuel, oil for lubrication. And wars are *won* finally, by the side with the greatest *reserves*.

"That is why American petroleum companies are pursuing their constant search for new oil more vigorously than ever—that's why the work of Pure Oil geologists is more important than ever right now.

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fronts so that America may have all the oil needed to win the war and ample reserves when victory is won.

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KALTENBORN: (NEWS)

The foregoing statement clearly sets out in language which the public can understand that the petroleum geologist and geophysicist are not only doing, but it is also necessary for them to do, very important work in the discovery of new and much needed reserves during the present emergency. What the announcer said with regard to The Pure Oil Company geologists is certainly applicable to the profession in general. We hope that more information along this line will be given to the public.

NOTICE TO ALL MEMBERS

Notice to all members planning on attending the A.A.P.G. Annual Meeting April 7, 8, 9, 1943: The Fort Worth-Dallas area is one of the busiest defense industry and military zones in the United States. Housing for transients is limited. All of the hotel rooms which will be available for the A.A.P.G. war conference have already been reserved and no additional reservations at hotels can be obtained. Most tourists courts in the area are full every night and only limited space is available in them. No space can be counted on in Dallas or other towns within commuting distance. The Fort Worth Geological Society, your host for the meeting, feels that it has a duty to warn all members and guests that it is unwise to come to Fort Worth unless you have a confirmed reservation in a hotel or private home. We want to be as hospitable as possible but we are definitely limited in our ability to house guests by the war time shortage of accommodations. Our frank advice, in which President F. L. Aurin of the A.A.P.G. concurs, is: stay home if you don't have a reservation. *Signed: FORT WORTH GEOLOGICAL SOCIETY.*

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209 Ellis-Singleton Building
Manager of Well Log Bureau - Harvel E. White
Regular Meetings: 7:30 P.M., Geological Room,
University of Wichita, first Tuesday of each month.
Visitors cordially welcomed.
The Society sponsors the Kansas Well Log Bureau
which is located at 412 Union National Bank
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Meets the first Monday of every month, October
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Caddo Parish Court House. Special dinner meet-
ings by announcement.

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State Geological Survey, Lansing
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Cities Service Oil Co., Mt. Pleasant

Meetings: Bi-monthly from November to April at
Lansing. Afternoon session at 3:00, informal din-
ner at 6:30 followed by discussions. (Dual meetings
for the duration.) Visiting geologists are welcome.

MISSISSIPPI	OKLAHOMA
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<p align="center">OKLAHOMA CITY GEOLOGICAL SOCIETY OKLAHOMA CITY, OKLAHOMA</p> <p><i>President</i> H. Travis Brown Cities Service Oil Company, Box 4577</p> <p><i>Vice-President</i> Lester L. Whiting The Texas Company, Box 354</p> <p><i>Secretary-Treasurer</i> I. Curtis Hicks Phillips Petroleum Company 1211 First National Building</p> <p>Meetings: Technical program each month, subject to call by Program Committee, Oklahoma City University, 24th Street and Blackwelder. Luncheons: Every Thursday, at 12:00 noon, Skirvin Hotel Coffee Shop.</p>	<p align="center">SHAWNEE GEOLOGICAL SOCIETY SHAWNEE, OKLAHOMA</p> <p><i>President</i> Grant W. Spangler Stanolind Oil and Gas Company</p> <p><i>Vice-President</i> Edwin A. Dawson 1829 N. Broadway</p> <p><i>Secretary-Treasurer</i> Marcelle Mousley Atlantic Refining Company</p> <p>Meets the fourth Thursday of each month at 8:00 P.M., at the Aldridge Hotel. Visiting geologists welcome.</p>
<p align="center">THE STRATIGRAPHIC SOCIETY OF TULSA TULSA, OKLAHOMA</p> <p><i>President</i> Ralph A. Brant Atlantic Refining Company, Beacon Building</p> <p>(Meetings discontinued until further notice)</p>	<p align="center">TULSA GEOLOGICAL SOCIETY TULSA, OKLAHOMA</p> <p><i>President</i> Glenn Scott Dillé Consulting Geologist, Atlas Life Building</p> <p><i>1st Vice-President</i> Maurice R. Teis The Ohio Oil Company</p> <p><i>2nd Vice-President</i> Myron C. Kiess The Pure Oil Company</p> <p><i>Secretary-Treasurer</i> Louis H. Desjardins Aero-Geologist, 739 Kennedy Bldg.</p> <p><i>Editor</i> Constance Leatherock Tide Water Associated Oil Company</p> <p>Meetings: First and third Mondays, each month, from October to May, inclusive, at 8:00 P.M., University of Tulsa, Kendall Hall Auditorium. Luncheons: Every Tuesday (October-May), Bradford Hotel.</p>
TEXAS	
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TEXAS

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Meetings will be announced

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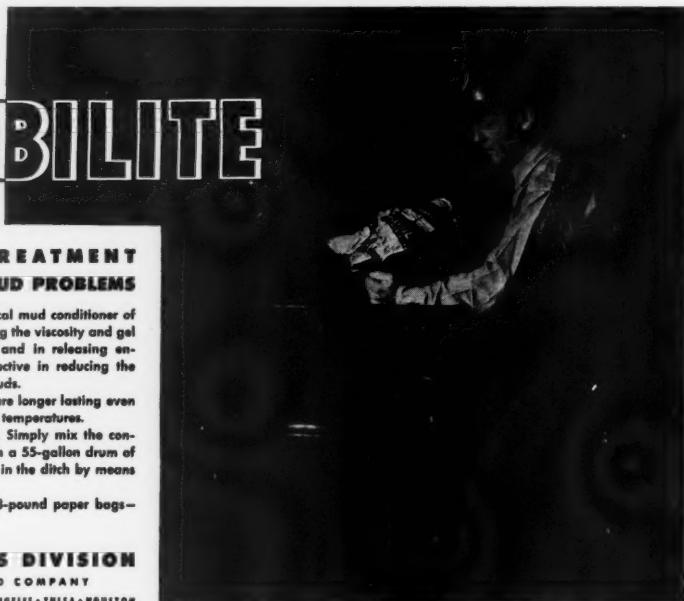
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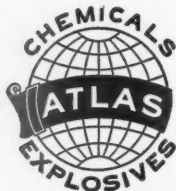
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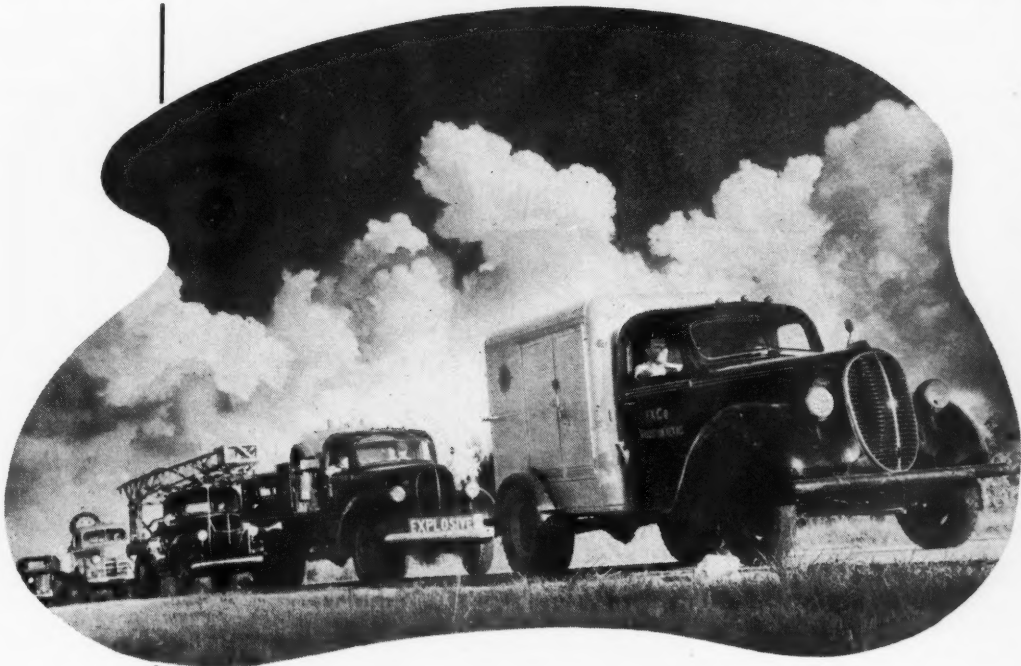
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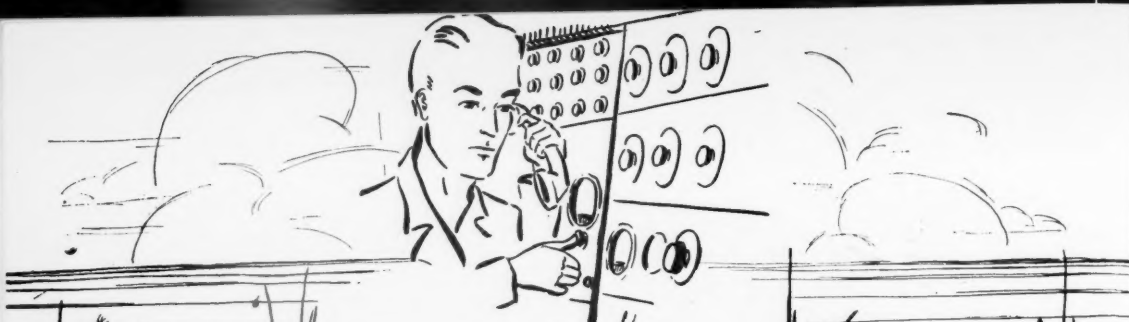
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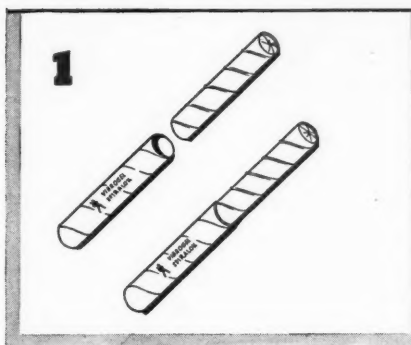


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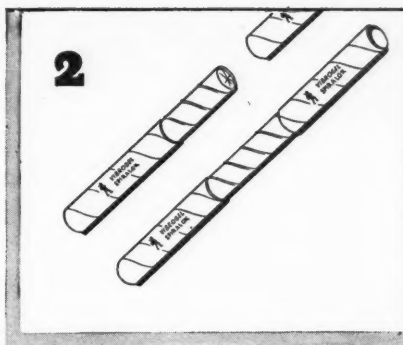


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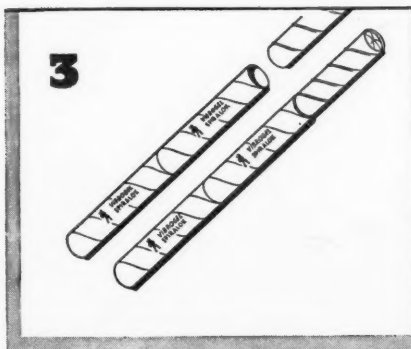
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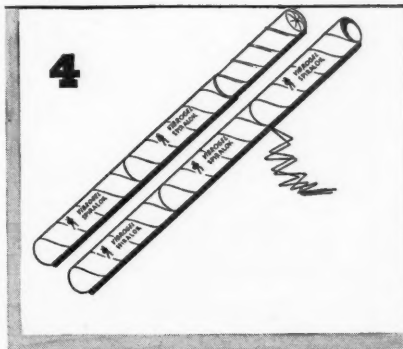
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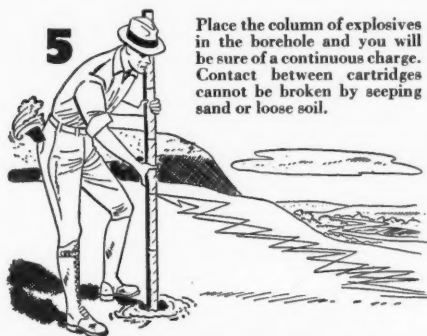


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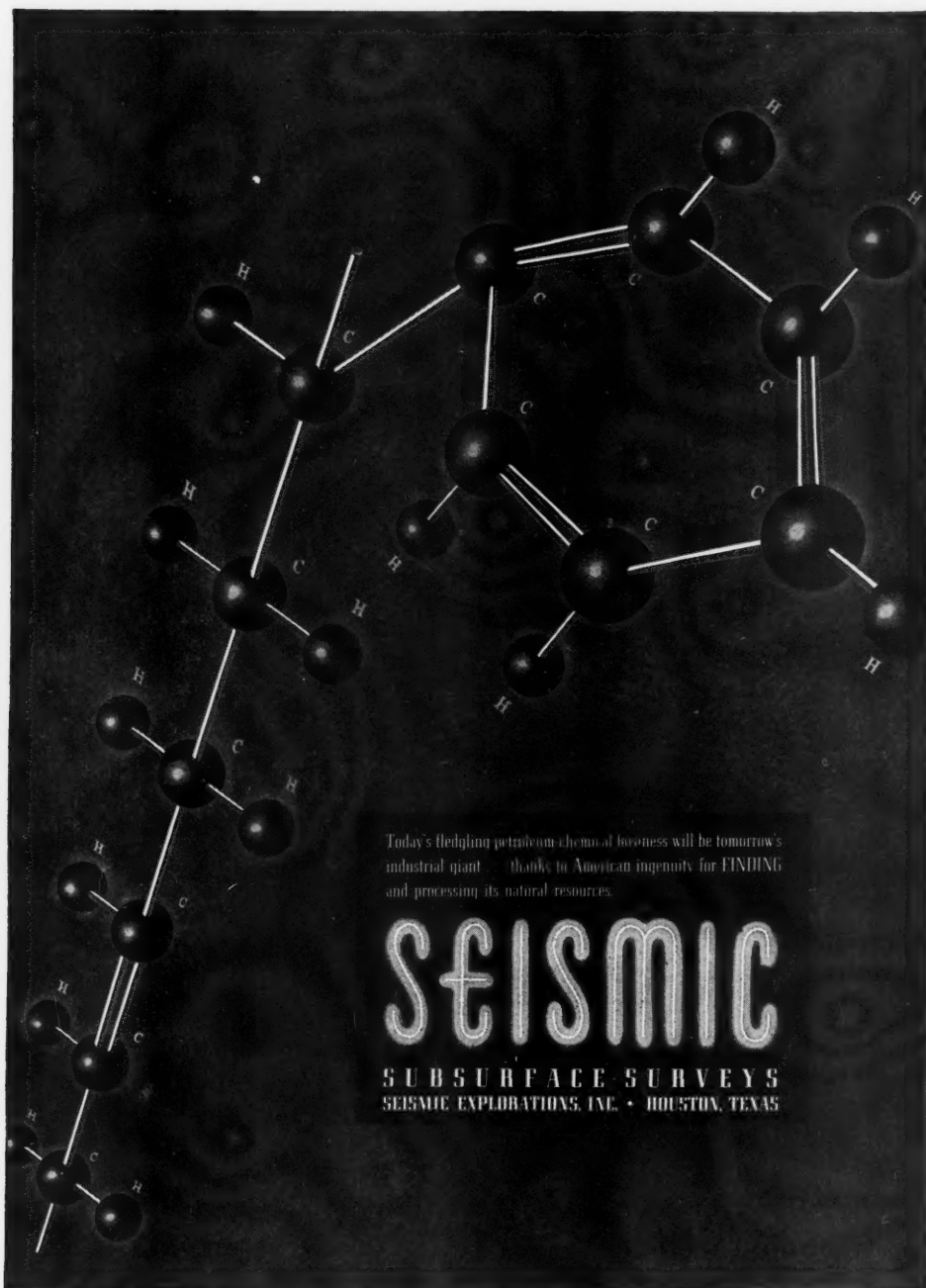
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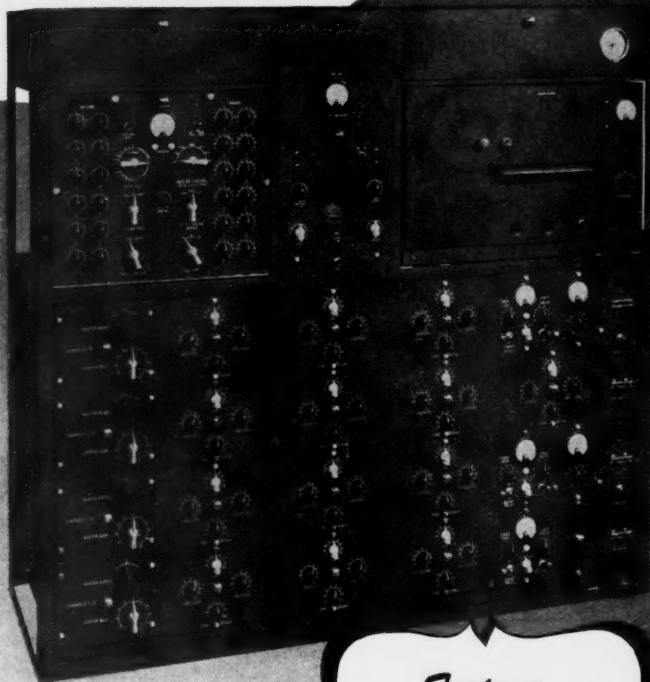
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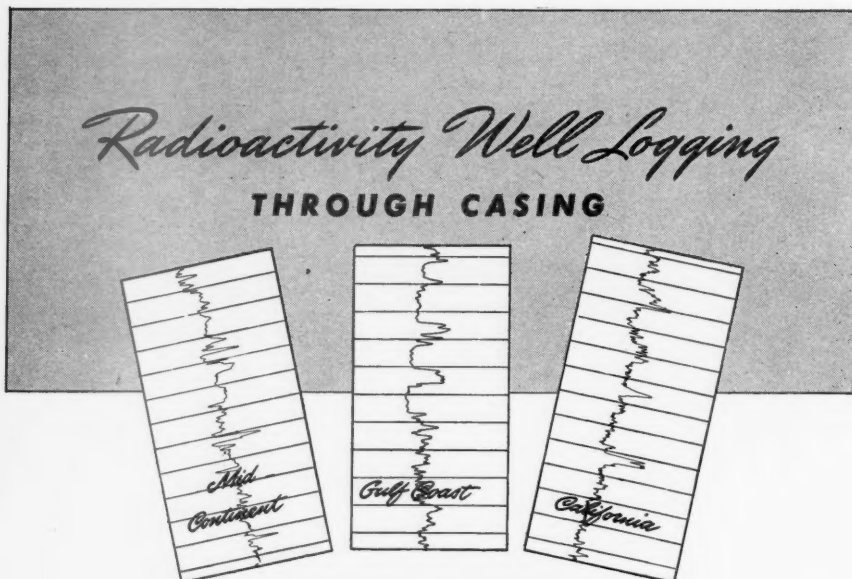
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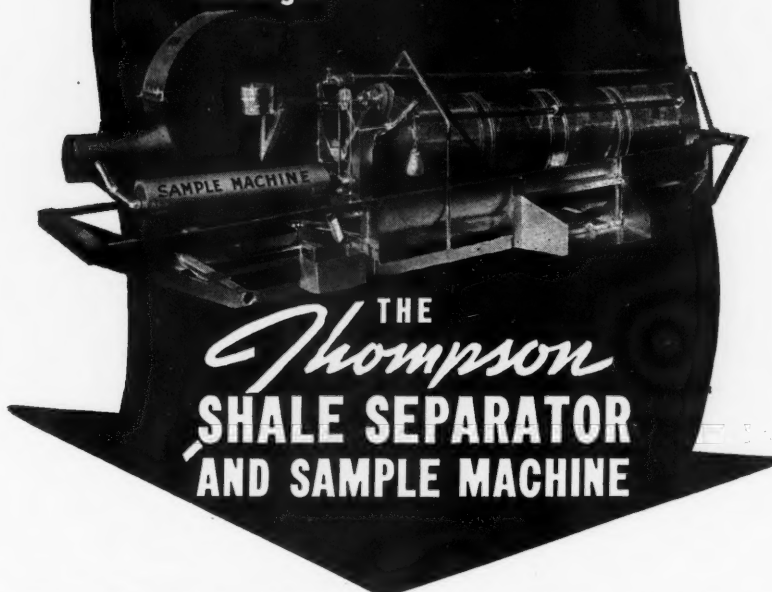
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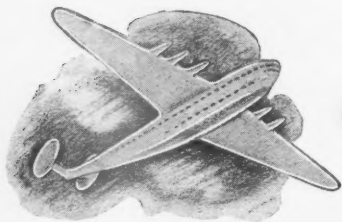
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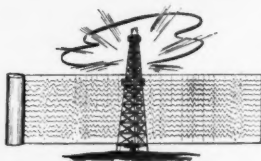




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